

Material Schedule

PROJECT – Data Centre

Document Name: Material Schedule

Document Number: LHR600-MCA-22-XX-RP-A-0200

Date : 23/03/2026

Revision : 01

Prepared By : IOK

Checked By : IOK

Approved By : SS

Planning Application Details:

Applicant: Marvell Developments LLC

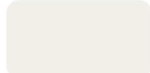
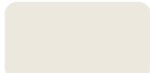


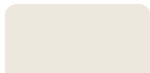
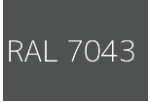
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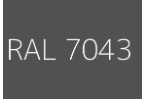
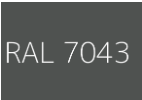





Proposal: Demolition of existing building and structures on site, and all other associated site clearance works.









Construction of a data centre building (Class B8) with plant at roof level with an emergency generator (1no.) and associated flue (provided within an external compound adjoining the data centre building), sprinkler tank and pumphouse, security guard house, and provision of one kiosk substation and MV Building.

Construction of a new access and internal road and circulation areas, footpaths, provision of car and bicycle parking, hard and soft landscaping and other associated works and ancillary site infrastructure.

Reference: 49261/APP/2024/2904.

DATA CENTRE BUILDING - FAÇADE MATERIALS				
Specification Reference	Material	Location	Finish	Colour Sample
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-001	FLAT PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS – UPPER CLADDING.	RAL 9010	 <p><b>Pure White R9010</b> Polyester SP25 0.5/0.6 Foodsafe 0.5 Gloss: 11</p>
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-001	FLAT PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS – UPPER CLADDING.	RAL 9002	 <p><b>Grey White R9002</b> Polyester SP25 0.5 Gloss: 35</p>
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-001	FLAT PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS – UPPER CLADDING.	RAL 7035	 <p><b>Light Grey R7035</b> Polyester SP25 0.5 Gloss: 35</p>
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-002	RIBBED PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS – LOWER CLADDING.	RAL 9007	 <p><b>Dark Silver Matt 9007M</b> Matt PVDF 0,6</p>
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-003	FLAT ALUMINIUM RAINSCREEN CLADDING	NORTH ELEVATION – LOWER CLADDING.	RAL 9002	 <p><b>Grey White R9002</b> Polyester SP25 0.5 Gloss: 35</p>
SECTION 05 50 00 – METAL FABRICATIONS. FAC-001	METAL COPING AND FLASHINGS	ALL ELEVATIONS	RAL 7043	 <p>RAL 7043</p>

Specification Reference	Material	Location	Finish	Colour Sample
SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS. FAC-010	STICK CURTAIN WALL SYSTEM WITH PROJECTING CAPPING.	NORTH ELEVATION – LOWER CLADDING.	RAL 7043 GLASS – CLEAR.	 RAL 7043
SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS. FAC-010	GLAZED SPANDREL PANELS TO CURTAIN WALL SYSTEM.	NORTH ELEVATION – LOWER CLADDING.	RAL 7043	 RAL 7043
SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS. FAC-010	GLAZING WITH SOLAR CONTROL FILM APPLIED TO INSIDE FACE	NORTH ELEVATION – LOWER CLADDING.	NATURAL	NATURAL
SECTION 08 11 13 – METAL DOORS AND FRAMES. EDR-001	EXTERNAL METAL DOORS.	ALL ELEVATIONS.	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 11 13 00 – LOADING DOCK EQUIPMENT. EDR-010	ROLLER SHUTTER DOOR.	NORTH ELEVATION.	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 05 50 00 – METAL FABRICATIONS. MPR-004	MESH CLADDING SYSTEM – ENCLOSURE.	SOUTH ELEVATION	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 22 14 00 – RAINWATER DRAINAGE. SWD-001	RAIN WATER DOWN PIPES AND HOPPERS – UPPER LEVEL.	EAST AND WEST ELEVATIONS	RAL 7035	 Light Grey R7035 Polyester SP25 0.5 Gloss: 35
SECTION 22 14 00 – RAINWATER DRAINAGE. SWD-001	RAIN WATER DOWN PIPES AND HOPPERS – LOWER LEVEL.	EAST ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6

Specification Reference	Material	Location	Finish	Colour Sample
SECTION 08 91 19 – FIXED LOUVRES. EWL-001	POLYESTER POWDER COATED LOUVRE SCREEN	EAST AND NORTH ELEVATION	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
MEP SCOPE.	GENERATOR FLUE	EAST ELEVATION	STAINLESS STEEL	
MEP SCOPE.	GENERATOR FLUE SUPPORT	EAST ELEVATION	RAL 7035	 Light Grey R7035 Polyester SP25 0.5 Gloss: 35
MEP SCOPE.	EXTERNAL PLANT – GENERATOR HOUSING.	EAST ELEVATION	RAL 7035	 Light Grey R7035 Polyester SP25 0.5 Gloss: 35
SECTION 07 50 00 – MEMBRANE ROOFING ROF-020	FLAT ROOF FINISH	ROOF	WHITE	
MEP SCOPE.	ROOFTOP PLANT AND EQUIPMENT.	ROOF	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 05 53 00 – METAL GRATINGS GRA-010	ROOFTOP PLATFORM WALKWAYS.	ROOF	GALVANISED FINISH	
SECTION 05 52 13 – PIPE AND TUBE RAILINGS. BAL-003	ROOFTOP PLATFORM GUARDING.	ROOF	GALVANISED FINISH	



# DATA CENTRE BUILDING - FAÇADE MATERIALS

FLAT PANEL METAL FACED COMPOSITE PANEL  
SAMPLE NUMBER:  
EWP-001

FLAT ALUMINIUM RAINSCREEN CLADDING  
SAMPLE NUMBER:  
EWP-003

GLAZING WITH SOLAR CONTROL FILM APPLIED TO INSIDE FACE  
SAMPLE NUMBER:  
FAC-010

EXTERNAL METAL DOORS.  
SAMPLE NUMBER:  
EDR-001

MESH CLADDING SYSTEM - ENCLOSURE  
SAMPLE NUMBER:  
MPR-004

RIBBED PANEL METAL FACED COMPOSITE PANEL  
SAMPLE NUMBER:  
EWP-002

METAL COPING AND FLASHING  
SAMPLE NUMBER:  
FAC-001

GENERATOR FLUE & SUPPORT  
SAMPLE NUMBER:  
MEP SCOPE

RAIN WATER DOWN PIPES AND HOPPERS -  
UPPER LEVEL  
SAMPLE NUMBER:  
SWD-001

ROOFTOP PLANT AND EQUIPMENT.  
SAMPLE NUMBER:  
MEP SCOPE

POLYESTER POWDER COATED LOUVRE  
SCREEN  
SAMPLE NUMBER:  
EWL-001

SITE FENCING  
SAMPLE NUMBER:  
CHARCOAL GREY COLOUR.

RIBBED PANEL METAL FACED COMPOSITE PANEL  
SAMPLE NUMBER:  
EWP-002

1 WEST ELEVATION  
Scale 1: 100

2 EAST ELEVATION  
Scale 1: 100

NOTES

REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800 FOR COLOUR FINISH ON ALL BUILDING EXTERNAL LIFE CYCLE CONTRACTOR TO PROVIDE PROOF FINISHING AND SAMPLES OF ALL MATERIALS FOR REVIEW

EXTERNAL LIGHTING TO LOW LEVEL, GLAZING CONSISTENTLY AT 1.8M ABOVE FF, WITH EXCEPTED HEIGHT WHERE NOT POSSIBLE. ALWAYS LOCATE DOOR DOORS WITH ENCLOSED EXTERNAL SECURE CASES

LEGEND

LEGEND - EXTERNAL FINISHES

- GLAZING TYPE 010: CLAM THICK FRAMED GLASS, WITH STONE WOOL INSULATION CORE. VERTICALLY CLAD. SMOOTH FLAT FINISH. COLOUR: REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800. SPECIFICATION REFERENCE: EWP-01-01-01
- GLAZING TYPE 015: CLAM THICK FRAMED GLASS, WITH STONE WOOL INSULATION CORE. VERTICALLY CLAD. SMOOTH FLAT FINISH. COLOUR: REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800. SPECIFICATION REFERENCE: EWP-01-01-02
- GLAZING TYPE 020: CLAM THICK FRAMED GLASS, WITH STONE WOOL INSULATION CORE. VERTICALLY CLAD. SMOOTH FLAT FINISH. COLOUR: REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800. SPECIFICATION REFERENCE: EWP-01-01-03
- GLAZING TYPE 025: CLAM THICK FRAMED GLASS, WITH STONE WOOL INSULATION CORE. VERTICALLY CLAD. SMOOTH FLAT FINISH. COLOUR: REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800. SPECIFICATION REFERENCE: EWP-01-01-04
- POWDER COATED ALUMINIUM FINISH: COLOUR: REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800. SPECIFICATION REFERENCE: EWP-02-01-01
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- POWDER COATED ALUMINIUM FINISH: COLOUR: REFER TO DESIGN INTENT COLOUR CONCEPT LHR600-MCA-22-XX OR A-800. SPECIFICATION REFERENCE: EWP-02-01-20

NOTE:

REFER TO DRAWING NUMBERS LHR600-MCA-22-XX OR A-800 FOR EXTERNAL WINDOW SCHEDULE LHR600-MCA-22-XX OR A-800 FOR EXTERNAL LIGHTING FIXTURES

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1		ISSUED FOR PERMIT			
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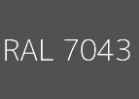
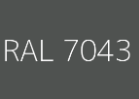


ARCHITECT: MCA Architects  
 Project: 22-XX OR A-800  
 1st Floor The Heights, Bakers Point, Dun Laoghaire, Co. Dub.  
 Dublin 24, Ireland

MECHANICAL ENGINEERS: Secoritas  
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 Apex Business Centre, Broomfield Road, Sandymount, Dublin D18 D016

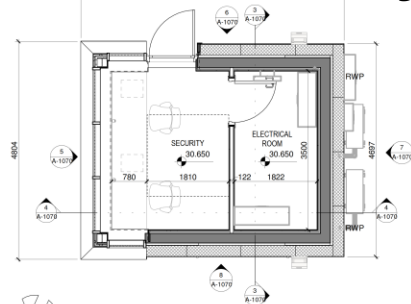
SECURITY ENGINEERS: Secoritas  
 Shane Clarke  
 +353 87 222 222  
 Apex Business Centre, Broomfield Road, Sandymount, Dublin D18 D016

LANDSCAPE ARCHITECT: HEDR  
 Alan Whelan  
 01 454 4444  
 One Wexham Way, Golden Common, Winchester, UK, SO21 1NG

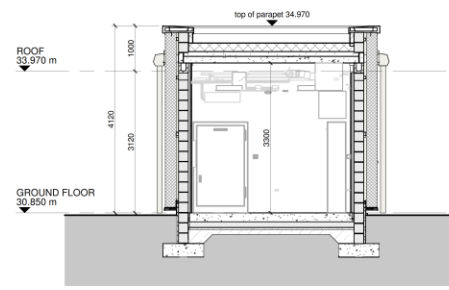
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 SCALE: 1: 100  
 REV: 1

SECURITY HUT BUILDING				
Specification Reference	Material	Location	Finish	Colour Sample
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-001	FLAT PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS	RAL 9016	
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-002	RIBBED PANEL METAL FACED COMPOSITE PANEL	NORTH, SOUTH, EAST ELEVATION	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 05 50 00 – METAL FABRICATIONS. FAC-001	METAL COPING AND FLASHINGS	ALL ELEVATIONS	RAL 7043	
SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS. FAC-010	STICK CURTAIN WALL SYSTEM WITH PROJECTING CAPPING.	NORTH, SOUTH, EAST ELEVATION	RAL 7043 GLASS – CLEAR.	
SECTION 22 14 00 – RAINWATER DRAINAGE. SWD-001	RAIN WATER DOWN PIPES AND HOPPERS – UPPER LEVEL.	EAST AND WEST ELEVATIONS	RAL 9016	
SECTION 07 50 00 – MEMBRANE ROOFING ROF-020	FLAT ROOF FINISH	ROOF	WHITE	

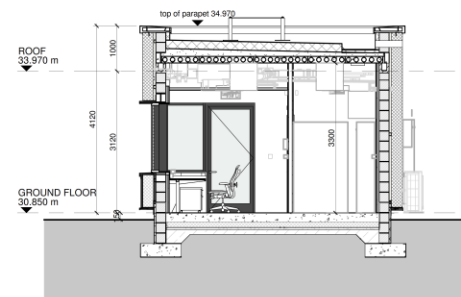
# SECURITY HUT BUILDING - FAÇADE MATERIALS



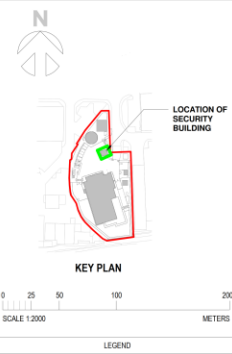
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**3 SECTION A**  
Scale 1:50



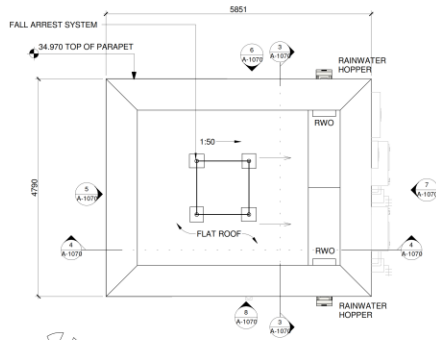
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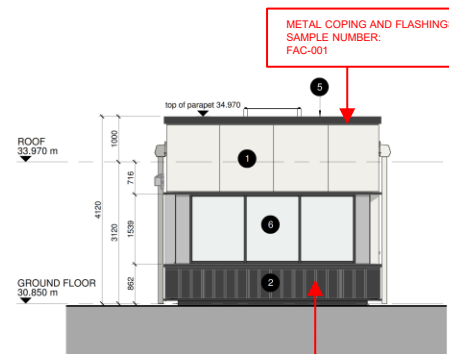
**MATERIAL LEGEND :**

- 1 GLASSING TYPE 01  
INSULATED WALL PANEL VERTICALLY LAID  
COLOUR: RAL 9016 TRAFFIC WHITE
- 2 GLASSING TYPE 02  
INSULATED WALL PANEL VERTICALLY LAID  
COLOUR: RAL 9007 GREY
- 3 PVC ALUMINIUM TRIMS AND FLASHINGS  
COLOUR: RAL 7043
- 4 PVC METAL FRAMED GLAZED CURTAIN WALL & DOOR  
COLOUR: RAL 7043
- 5 PVC RAINWATER PIPEWORK  
COLOUR: RAL 9016 TRAFFIC WHITE

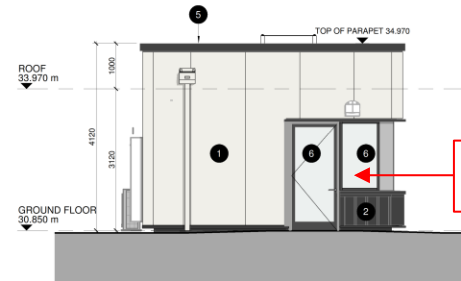
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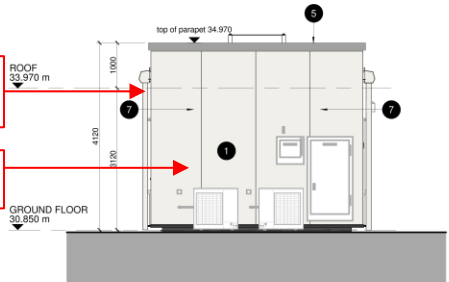
**2 ROOF PLAN**  
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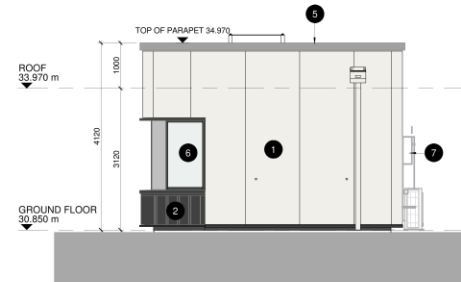
**5 EAST ELEVATION**  
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**6 SOUTH ELEVATION**  
Scale 1:50



**7 WEST ELEVATION**  
Scale 1:50



**8 NORTH ELEVATION**  
Scale 1:50

REV	DATE	DESCRIPTION	DIN (ENGL) APP
PRJ		PLANNING SUBMISSION	C2 BR - UK - 05

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CLIENT:	CONSULTANT:
MCA Ireland Simon Rodgers +353(0)1 453 5000 A Harbour View, Aspley Rd, Dublin 15, IRELAND	CGI ARCHITECTURAL ENGINEERS CGI Rustall Du Plessis (Chartered Incorporates) 1st Floor, The Heights, Balcora Point, Dun Laoghaire, Dublin, A68 0020
MCHIELLE ENGINEERS Ethos Engineering Unit 17 (Phase 1) Park Road (E) +353(0)1 222 2222 Athen Business Centre, Blackthorn Road, Sandyford, Dublin D18 0N78	SECURITY ENGINEERS Securitas Ireland Centre +353(0)1 952 2222 Suite 70, Blackthorn Business Park, Clonsilla, Dublin 15, D15 A8M9
LANDSCAPE ARCHITECT: H2L4 Alan Woodman 0176271100 One Wexham Way, Oxford Common Middletown, UK, OX1 1AC	OTHER CONSULTANT: Landscape Rural Planning 020 7657 4477 The Manor Building, 27 Mincing Lane, London EC3R 1AY







PROJECT: DATA CENTRE

TITLE: PROPOSED SECURITY BUILDING - PLANS, ELEVATIONS & SECTIONS

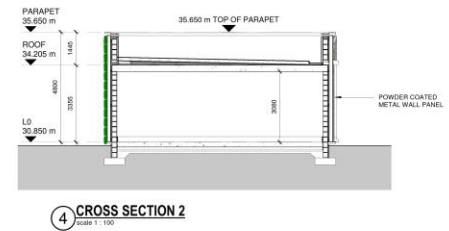
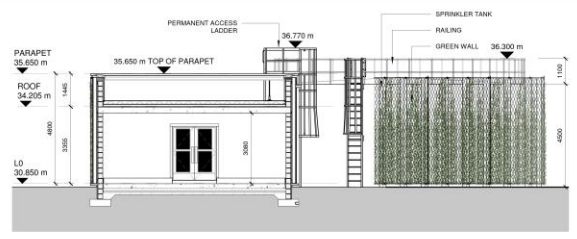
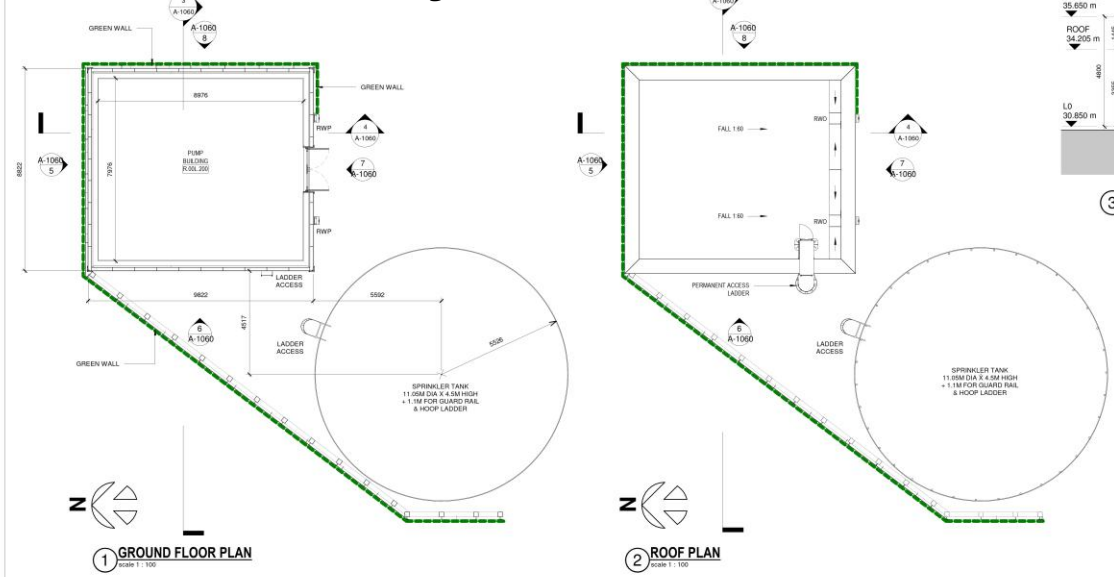
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FILE NO: 850 MCA-24-XX-01A-1070

PAPER SIZE: ISO A1 SCALE: As indicated REV: P01

<b>PUMP HOUSE BUILDING</b>				
Specification Reference	Material	Location	Finish	Colour Sample
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-002	RIBBED PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 05 50 00 – METAL FABRICATIONS. FAC-001	METAL COPING AND FLASHINGS	ALL ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 08 11 13 – METAL DOORS AND FRAMES. EDR-001	EXTERNAL METAL DOORS.	SOUTH ELEVATION.	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 22 14 00 – RAINWATER DRAINAGE. SWD-001	RAIN WATER DOWN PIPES AND HOPPERS – UPPER LEVEL.	EAST AND WEST ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 07 50 00 – MEMBRANE ROOFING ROF-020	FLAT ROOF FINISH	ROOF	WHITE	
SECTION 05 51 33 – METAL LADDERS LAD-001	ACCESS LADDER	WEST ELEVATION	GLAVANISED FINISH	
LANDSCAPE SCOPE	GREEN WALL	SCREEN TO BUILDING AND SPRINKLER TANK	PLANTING TO LANDSCAPE DETAIL	

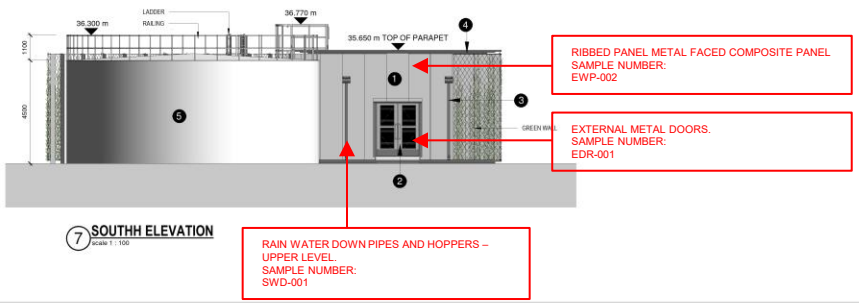
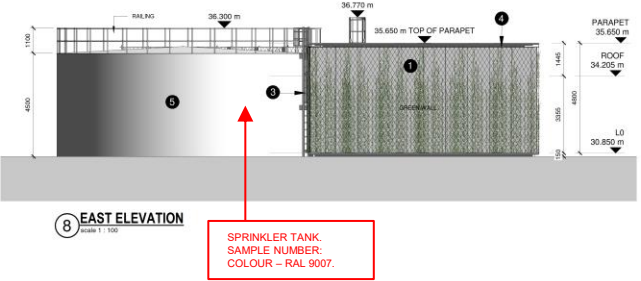
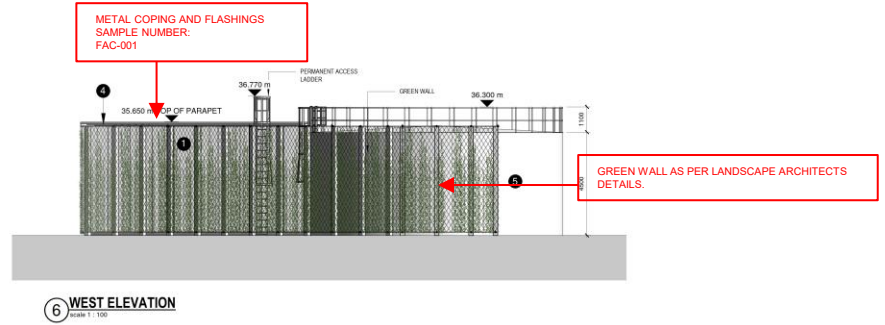
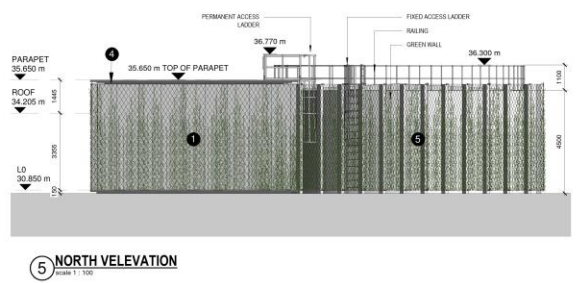
# PUMP HOUSE BUILDING - FAÇADE MATERIALS



**MATERIAL LEGEND :**

- INSULATED WALL PANEL VERTICALLY LAID  
COLOUR: RAL 9007
- POWDER COATED GALVANIZED DOOR  
COLOUR: RAL 9007
- PPC RAINWATER PIPEWORK  
COLOUR: RAL 9007
- PPC ALUMINIUM TRIMS AND FLASHINGS  
COLOUR: RAL 9007
- SPRINKLER TANK  
COLOUR: RAL 9007

SCALE 1:100








REV	DATE	DESCRIPTION	DRN (DRG) CHK APP
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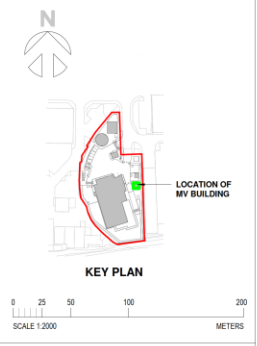
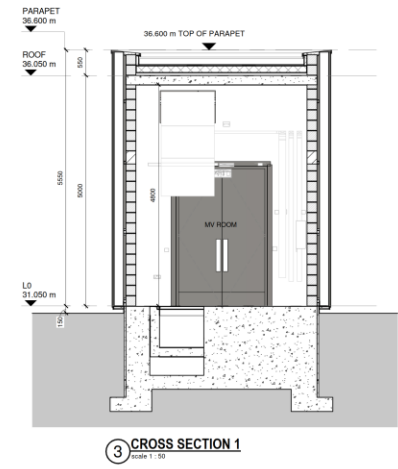
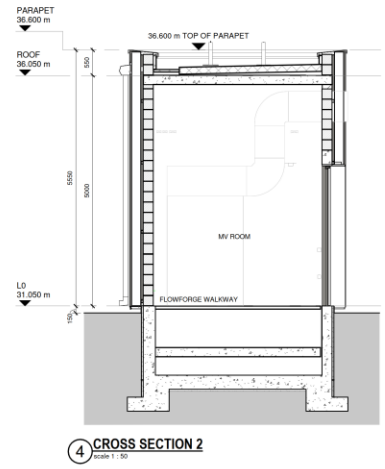
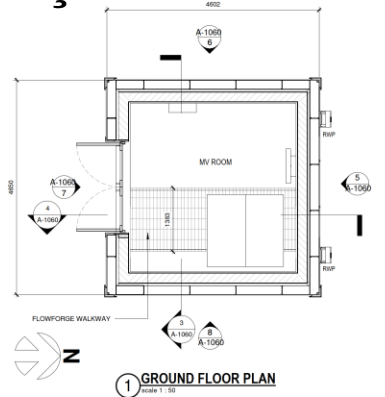
CONFIDENTIAL	
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LANDSCAPE ARCHITECT	LANDLAB Nuala Whelan 020 7657 4477 The Mosaic Building, 21 Mincing Lane, London EC3N 2JG

DATA CENTRE	
TITLE	PROPOSED SPRINKLER TANK BUILDING PLANS, SECTION & ELEVATION
SHEET NO	A-1060
FILE NO	600 MCA-03-XX-ORA-1060
PAPER SIZE	ISO A1
SCALE	As indicated
REV	P01

MV BUILDING				
Specification Reference	Material	Location	Finish	Colour Sample
SECTION 07 42 00 – WALL CLADDING PANELS. EWP-002	RIBBED PANEL METAL FACED COMPOSITE PANEL	ALL ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 05 50 00 – METAL FABRICATIONS. FAC-001	METAL COPING AND FLASHINGS	ALL ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 08 11 13 – METAL DOORS AND FRAMES. EDR-001	EXTERNAL METAL DOORS.	SOUTH ELEVATION.	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 22 14 00 – RAINWATER DRAINAGE. SWD-001	RAIN WATER DOWN PIPES AND HOPPERS – UPPER LEVEL.	EAST AND WEST ELEVATIONS	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 07 50 00 – MEMBRANE ROOFING ROF-020	FLAT ROOF FINISH	ROOF	WHITE	

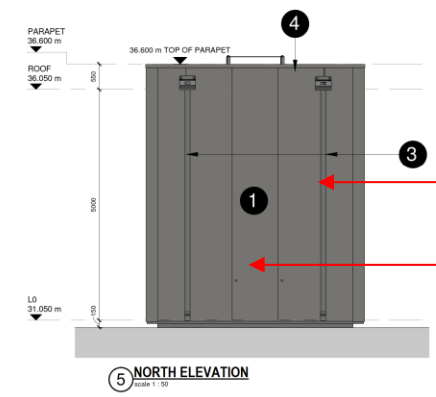
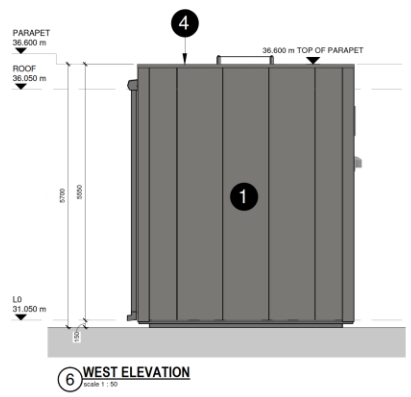
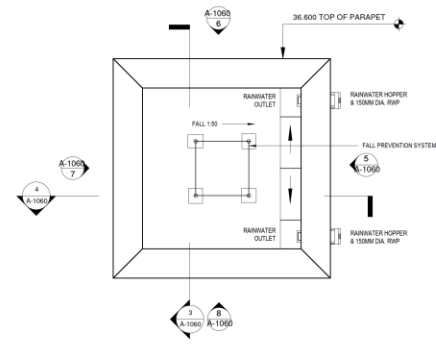
# MV BUILDING - FAÇADE MATERIALS



**MATERIAL LEGEND :**

- 1 INSULATED WALL PANEL VERTICALLY LAID  
COLOUR: RAL 9007
- 2 POWDER COATED GALVANIZED DOOR  
COLOUR: RAL 9007
- 3 PPC RAINWATER PIPEWORK  
COLOUR: RAL 9007
- 4 PPC ALUMINIUM TRIMS AND FLASHINGS  
COLOUR: RAL 9007

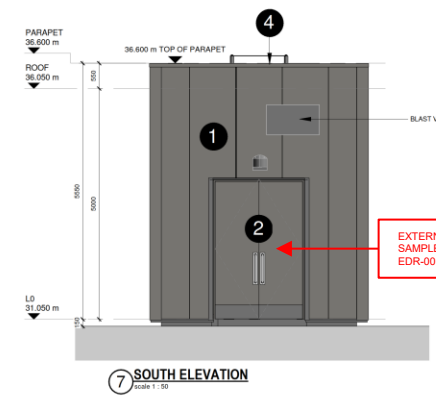
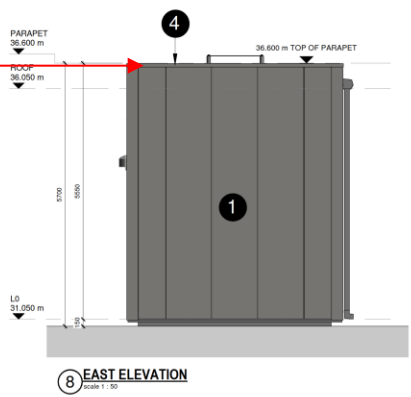
0 0.5 1 2.5 5  
SCALE 1:50  
METERS



RAIN WATER DOWN PIPES AND HOPPERS – UPPER LEVEL.  
SAMPLE NUMBER: SWD-001

RIBBED PANEL METAL FACED COMPOSITE PANEL  
SAMPLE NUMBER: EWP-002

METAL COPING AND FLASHINGS  
SAMPLE NUMBER: FAC-001



EXTERNAL METAL DOORS.  
SAMPLE NUMBER: EDR-001

REV	DATE	DESCRIPTION	DRN (ENGL) APP
REV	DATE	DESCRIPTION	DRN (ENGL) APP
REV	DATE	DESCRIPTION	DRN (ENGL) APP

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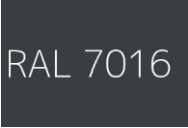







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PROJECT: DATA CENTRE  
TITLE: PROPOSED MV PLANS, SECTION & ELEVATION

SHEET NO: A-1060  
FILE NO: 600-MCA-Q2-XX-DR-A-1060  
PAPER SIZE: ISO A1 SCALE: As indicated REV: P01

SITE FINISHES				
Specification Reference	Material	Location	Finish	Colour Sample
SECTION 32 31 16 – FENCES AND GATES	SITE FENCING	SITE	RAL 7016 CHARCOAL GREY	
LANDSCAPE SCOPE	BIN STORE - WEBNET PLANTING MESH	SITE	STAINLESS STEEL	
STRUCTURAL SCOPE	BIN STORE - FRAMING	SITE	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
LANDSCAPE SCOPE	BIN STORE – EXPANDED METAL MESH	SITE	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
LANDSCAPE SCOPE	SPRINKLER TANK.	SITE	RAL 7035	 Light Grey R7035 Polyester SP25 0,5 Gloss: 35
CIVIL SCOPE	SITE BOLLARDS	SITE	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
SECTION 05 50 00 – METAL FABRICATIONS. BSH-001	BIKE SHELTER - FRAMING	SITE	RAL 9007	 Dark Silver Matt 9007M Matt PVDF 0,6
LANDSCAPE SCOPE	BIKE SHELTER – WEBNET PLANTING MESH.	SITE	STAINLESS STEEL	

Material Schedule

Samples – Specification Register

SECTION 05 53 00 METAL GRATINGS  
SECTION 05 50 00 METAL FABRICATIONS  
SECTION 05 51 33 METAL LADDERS  
SECTION 07 42 00 WALL CLADDING PANELS  
SECTION 07 50 00 MEMBRANE ROOFING  
SECTION 08 11 13 METAL DOORS AND FRAMES  
SECTION 08 44 13 GLAZED ALUMINUM CURTAIN WALLS  
SECTION 08 91 19 FIXED LOUVRES  
SECTION 11 13 00 LOADING DOCK EQUIPMENT  
SECTION 22 14 00 RAINWATER DRAINAGE

**SECTION 05 53 00 – METAL GRATINGS****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

To be read with the Contract, Drawings and other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 SUMMARY**

- A. This section describes the specialist Contractor's design and installation of mild steel floor gratings, in locations shown on the drawings. This specification is to be read in conjunction with the design intent drawings and documents prepared for the project.
- B. The Contractor shall design, test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation. To include all items necessary for full completion and finishing of the work not necessarily included.
- C. Section shall include but not be limited to the following:
  - 1. Metal bar gratings.
  - 2. Expanded-metal gratings.
  - 3. Formed-metal plank gratings.
  - 4. Metal frames and supports for gratings.

**1.2.1 COMPONENT/ELEMENT TYPES**

GRA-010 – METAL GRATINGS TO RISERS

GRA-011 – METAL GRATINGS WITH DURBAR FLOORING PLATE

GRA-012 – GPR PLATFORMS / WALKWAYS

**1.3 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: The Contractor shall design the gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the applicable loads and stresses within limits and under conditions which the Contractor shall determine via site surveys.

**1.3.1 DEFINITIONS**

- A. Where the word 'Design' occurs in this document it will be described as 'Design\*'. The Asterisk implies that 'Under the design portion requirements of this specification the Contractor is requested to take the design intent and apply their own manufacturers systems and materials performance data to comply with all criteria set out in this specification document and the design intent drawings'.
- B. GLOSSARY OF TERMINOLOGY
  - 1. Load Bearing Bars – A longitudinal load carrying bar of uniform section spanning between supports.
  - 2. Transverse Bar – A member fixed at right angles to the load-bearing bars to provide lateral restraint.
  - 3. Binding Bar – A bar fixed to the edge of a fabricated flooring panel fitting flush with the top of the load-bearing bars.
  - 4. Deep Binding Bar – A bar fixed to the edge of a fabricated flooring panel of greater depth than the load-bearing bar, projecting below the underside.
  - 5. Span & Length – Running parallel with the load-bearing bars, this is the overall dimension of a flooring panel. This dimension is always referred to as 'length' even if it is shorter than the width.
  - 6. Width – Running right angles to the load-bearing bars, this overall dimension is referred to as the 'width' even if it exceeds the length.
  - 7. Pitch – The pitch is the calculated as the distance centre-to-centre of the load bearing bars or centre-to-centre of the transverse bars.
  - 8. Plain vs Serrations – Plain flooring has load-bearing bars that are smooth. Serrations have notches formed in the top surface of the load-bearing bars to improve slip resistance.
  - 9. Nosing Bar / Slip Resistance – Edging Nosing Bars are members welded to the front edge of a stair tread or to a flooring panel for sighting and slip resistance.
  - 10. Toe Plate / Kick Flat / Kick Plate – Toe plate is a flat bar welded around a flooring panel projecting above the top of the load-bearing bars.

11. End Plate – A plate welded to a stair tread for fixing to s stringer.
12. Curb Angle – A rolled steel angle (RSA) fixed to concrete or supporting steelwork at the perimeter of a flooring area.

## 1.5 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT

Building Regulations 2010

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

BRITISH STANDARDS INSTITUTION

EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.

EN 485-2:2008 Aluminium and aluminium alloys. Sheet, strip and plate. Mechanical properties.

EN 754-2:2008 Aluminium and aluminium alloys. Cold drawn rod/bar and tube. Mechanical properties.

EN 755-2:2008 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Mechanical properties.

EN 1706:2010 Aluminium and aluminium alloys - Castings - Chemical composition and mechanical properties.

EN 1991-1-1:2002 Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings. + AMD 15507, Corrigendum February 2010

EN 1993-1-4:2006 Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels.

EN 1999-1-1:2007 Eurocode 9: Design of aluminium structures. General structural rules. + AMD 2009

EN 10025-2:2004 Hot rolled products of structural steels. Technical delivery conditions for non-alloy structural steels.

EN 10088-2:2005 Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.

EN 10088-3:2005 Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.

EN 10210-1:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

EN 10219-1:2006 Cold formed welded structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

BS 1134:2010 Assessment of surface texture - Guidance and general information.

BS 4592-3:2006 Industrial type flooring and stair treads. Cold formed metal planks. Specification.

BS 4800:2011 Schedule of paint colours for building purposes.

BS 6100-6:2008 Building and civil engineering. Vocabulary. Construction parts.

BS 6180:2011 Barriers in and about buildings. Code of practice.

BS 7976-1:2002 Pendulum testers. Specification. A1:2013

BS 7976-2:2002 Pendulum testers. Method of operation. A1:2013

BS 7976-3:2002 Pendulum testers. Method of calibration.

BS 8118-2:1991 Structural use of aluminium. Specification for materials, workmanship and protection. + AMD 10486

EN ISO 14713: 1999 Protection against corrosion of iron and steel in structures – Zinc and aluminium coatings – Guidelines.

EN ISO 1461: 1999 Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods.

EN 10240: 1998 Coatings for steel tubes: Specification for hot dip galvanized coatings.

ISO 4628-3: 1982 Paints and varnishes – Evaluation of degradation of paint coatings – Designation of intensity, quantity and size of common types of defect – Part 3: Designation of degree of rusting.

BS 7079: Part A1 Preparation of steel substrates before application of paints and related products – Visual assessment of surface (ISO 8501-1) cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.

EN 22063: 1994 Metallic and other inorganic coatings – Thermal spraying – Zinc, Aluminium and their alloys.

BS 8300:2009 Design of buildings and their approaches to meet the needs of disabled people. Code of practice. + AMD July 2010

BS 8493:2008 Light reflectance value (LRV) of a surface. Method of test. + AMD March 2010

BS 9999:2008 Code of practice for fire safety in the design, management and use of buildings.

NA to EN 1991-1-1:2002:2005 UK National Annex to Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings.  
 NA to EN 1993-1-4:2006:2009 UK National Annex to Eurocode 3. Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting.  
 NA to EN 1999-1-1:2007:2008 UK National Annex to Eurocode 9: Design of aluminium structures. General structural rules. + AMD March 2010, Corrigendum May 2010  
 INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)  
 ISO/CD 21542:2008 Building construction. Accessibility and usability of built environment. 2008 UK SLIP RESISTANCE GROUP (UKSRG)  
 Assessment of floor slip resistance. The UK Slip Resistance Group guidelines. Issue 4. 2011  
 WASTE AND RESOURCES ACTION PROGRAMME (WRAP)  
 Guide Choosing construction products: Guide to the recycled content of mainstream construction products. Version 4. 2008

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Formed steel plank gratings.
  2. Clips and anchorage devices for gratings.
  3. Paint products.
- B. Manufacturer's Certificates: For each type of product.
1. Certificates stating that the gratings meet the requirements of the Construction Products Regulation (CPR) 2013 and European Standard EN 1090-1: 2009 + A1: 2011 'Execution of steel structures and aluminium structures Part 1: Requirements for conformity assessment of structural components' which fulfils the requirement for Conformité Européenne (CE) Marking, Declarations of Performance and Declarations of Conformity.
- C. Warranty: Submit written guarantee, conforming to General Condition requirements, and to Contract requirements.
- D. Product / Manufacturer's Literature and Data:
1. Manufacturer's product lines of mechanically connected gratings.
  2. Grating support brackets.
  3. Grout, anchoring cement, coating and paint products.
- E. SHOP DRAWINGS: Include plans, elevations, sections, details, and attachments to all other work. To include, but not be limited to detail drawings indicating how all floor grating supports will be fixed, to floor slab(s), internal and external walls, interface(s).
1. Scale drawings of all gratings, to include but not be limited to grating panel layouts, support fixings, span direction, etc.
  2. Details of all gratings, including vertical and horizontal edge details and all fixing component thicknesses. Include calculations of loadings and structural fixings prepared by a structural engineer employed by the Contractor appointed to complete the work described in this section.
  3. Mild steel grating details, including dimensioned profiles and metal thicknesses.
  4. Locations of attachment reinforcement where necessary and preparations for structural attachment.
  5. Details of each component condition.
  6. Details of anchorages, joints, and connections.
  7. Details of accessories.
  8. Details of profiles, removable stops, solid infill panels as shown on the drawings.
- F. Samples for Initial Selection: For products involving selection of colour, texture, or design, including mechanical finishes on mild steel.
1. Samples for Verification: For each type of exposed finish required.
  2. Sections of each distinctly different floor grating member.
  3. Fittings and brackets.
  4. Assembled Sample(s) of one full module (minimum 1.0 linear metre) of each floor grating type system(s), made from full-size components. Samples should include all proposed base and wall attachment proposals to include, where appropriate, soffit and fascia assemblies and associated fixings.  
 Show method(s) of finishing and/or connecting all members at intersections.
- G. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- H. Declarations of Performance (DOPs) are to be provided for all installed products.
- I. SHOP DRAWINGS: Include plans, sections, at 1:50 scale and details, at 1:10 scale and attachments to other work.
- J. DELEGATED-DESIGN SUBMITTAL: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.7 INFORMATION SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Metal Bar Grating Standards: Comply with BS 4592-1:2006 'Industrial type flooring and stair treads. Metal open bar gratings. Specification'.

### 1.8 METHOD STATEMENTS

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

### 1.9 CLOSEOUT SUBMITTALS

- A. Copies of structural design calculations/ test reports.
- B. General product information.
- C. Installation information, to include photographs of structural fixings prior to covering up with finishing work.
- D. Inspection and maintenance reports.
- E. Certification of compliance with the Building Regulations for the purposes of compliance with Building Control (Amendment) Regulations 2014 (S.I. 9).

### 1.10 MAINTENANCE SUBMITTALS

Submit the following for inclusion in the maintenance manual for the building:

- Manufacturer's Instructions
- Cleaning Materials and recommended methods of cleaning.
- Preventative Maintenance and Inspection recommendations.
- Maintenance Instructions.

### 1.11 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

### 1.12 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

### 1.13 QUALITY ASSURANCE

- A. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.  
Fabricator Qualifications: Furnish references listing projects of similar size and scope.  
Source Limitations: Obtain the floor gratings etc., from single source from single manufacturer.
- B. Components and installation are to follow current BS, EN ICC standards and guidelines.
- C. Certifications:
  - 1. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
  - 2. Furnish certification that components were installed in accordance to the manufacturer's engineering data to meet the specified design loads.
- D. The manufacturer(s) of all installed products to the project is, upon completion of the works to provide written certification that all products are installed in accordance with their instructions, and in accordance with the UK Building Regulations Technical Guidance / Approved Documents 2010, all current National and European Codes of Practice and Standards, and the requirements of this, the Specification prepared for the project.

#### 1.14 WARRANTY

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of ten years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.
- B. Warranties from the Grating Contractor are required for the design of the system and its components. Warranties or letters of certification, in writing, are also required from principal material suppliers, confirming that their materials are being used in such a manner that the requirements of the Contract Documents are met.

#### 1.15 DECLARATION OF CONFORMANCE

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
- The performance requirements for the project.
- The technical specifications standards described herein.

From July 2014 Structural steelwork and aluminium fell under the CPR and therefore requires DOPs and CE Marking to be affixed to show compliance with EN 1090-1.

#### 1.16 SINGLE SOURCE WARRANTY

- A. All components and 'build-up of components' shall be covered by a single source, warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified.
- B. All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions.
- C. Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Employer's Representative.

#### 1.17 PERFORMANCE REQUIREMENTS

- A. The design, supply, installation and finishing of metal floor gratings as shown on the drawings.
- B. The Contractor shall be responsible for all aspects of design, construction, testing, fabrication, detailing and installation to comply with the Statutory and Operational requirements for metal floor gratings and the requirements of this Specification. This shall include ensuring that all interfacing requirements relating to the building structure are accommodated in accordance with the Employer's Representative's approval.
1. The provision of testing data or the carrying out of tests does not relieve the Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.
  2. The extent of any damage determined through testing shall be recorded and, where possible, quantified. Details shall be submitted to the Employer's Representative for approval.
  3. Details of tests shall be provided to demonstrate the performance of materials and finishes in resisting abrasion from pedestrian traffic (luggage, wheeled trolleys, footwear, etc.) and any other abrasion resulting from adjacent traffic movements.
- C. Construction shall comply with the visual requirements indicated on the Tender Drawings, and provide a consistent finish to all surfaces.
- D. the Contractor shall undertake the Detailed Design maintaining the function, visual requirements, performance and intent of the Design.
- E. The design and visual character of the project is important and shall be maintained.
- F. Selected materials shall be durable and satisfy the requirements of the Specification for the design life of the works.
- G. The works shall perform throughout its design life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.
- H. Accidental Damage/ Robustness: The works shall comply with Technical Guidance / Approved / Approved Documents of the Building Regulations.
- I. Electro-chemical corrosion or staining resulting from water running from one material to another shall be prevented.

- J. Generally, surfaces shall be sufficiently hard and scratch resistant to resist impacts due to normal maintenance operations without any noticeable change to the surface appearance.

#### 1.18 STRUCTURAL REQUIREMENTS

##### A. LOADING ASSUMPTIONS

The buildings are classified in accordance with IS EN 1991-1-1: General Actions – Densities, self-weight, imposed loads for buildings.

All metal floor gratings are to be designed to the requirements of IS EN 1991-1-1: General Actions – Densities, self-weight, imposed loads for buildings and its National Annex as they relate to this classification.

##### B. SPECIFIC MOVEMENTS

1. The Contractor shall take into account all differential movements with the collective structures and allow for appropriate movement joints with all attendant and associated interfaces and profiles etc.
2. Particular attention is to be paid to the infill grated floor panels and all associated components.
3. All fixings shall be capable of providing adequate adjustment with the minimal use of packing shims.
4. All necessary movement joints shall be designed to accommodate the maximum movements that can be derived from the specified and determined design loads and movements. Under maximum movements the joints shall meet the requirements of the Specification.
5. The works shall resist all specified static and dynamic design loads likely to be encountered without causing permanent deformation of components or the failure of members or seals and shall transmit such loads safely to the points of support.  
The works shall not deflect under loading in any way that is detrimental to any elements the works or adjacent structural or building elements.  
The works shall accommodate the following movements without any permanent deformation or reduction in the specified performance:
  - a. Deflection under design loads.
  - b. The effects of internal/ external wind and pressure loadings.
  - c. Changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.
  - d. Movement of any joint whether designed to permit movement or not.
  - e. Thermal movements

##### C. DEFLECTION

1. The works shall not deflect under loading in any way that is detrimental to any element of themselves or adjacent structural or building elements.
2. All components, couplings and fixings shall be capable of accommodating all of the above deflection without permanent distortion, deformation or failure.
3. The works shall accommodate differential structural movements arising from any loads imposed by adjacent structures, the works, their support structure or internal finishes.

#### 1.19 CONTRACTOR'S ENGINEER OF RECORD

The Contractor's Engineer of Record must be currently licensed within the jurisdiction of the project.

The Engineer of Record must be approved, authorized, and currently licensed by the Institution of Engineers of Ireland (IEI), and have a minimum of five years' experience as an approved Engineer.

The Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. The Engineer of Record must provide certified engineering calculations for:

Metal grated flooring and all associated requirements in accordance with British Standard and European codes.

#### 1.20 PROJECT CONDITIONS

- A. Field Measurements: The Contractor shall verify all actual locations of walls and other construction contiguous with metal floor grating fabrications by field measurements before fabrication.

#### 1.21 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items

with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

#### 1.22 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed with a maintenance free life in excess of 20 years. Within the period of 'maintenance free life' the assembly shall perform at or above the levels specified elsewhere. In accordance with BS ISO 15686-5:2008 'Buildings and constructed assets. Service life planning. Life cycle costing'.
- B. The term 'Maintenance' shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.
- D. COMPONENT PARTS: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Employer's Representative must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.
- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.23 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Validation according to the Eco-Management and Audit System (EMAS).
  - 3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. Mild steel floor gratings and associated systems as designed, supplied and installed by a manufacturer regularly engaged in the design and production of such systems.

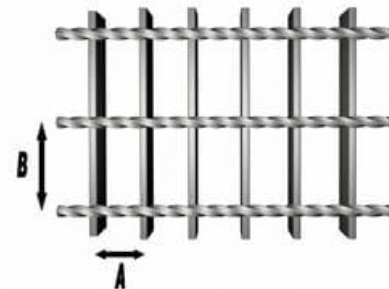
SECTION 05 53 00

**PART 2 – PRODUCTS**

GRA-010 METAL GRATINGS

- A. The Contractor shall install the floor gratings, in accordance with BS 4592-1:2006 'Industrial type flooring and stair treads. Metal open bar gratings. Specification' and including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Floor Gratings shall withstand all loading to include but not be limited to the effects of gravity loads and the applicable loads and stresses under conditions which the Contractor shall determine via establishing the future operational requirements and site surveys.
- C. Provide open steel rectangular pattern flooring, configured to sizes and profiles as indicated on the Drawings, suitably fixed to structural framework system (to Contractor's specification). The flooring shall be constructed from mild steel to EN 10 025 Fe430A and by a forge-welding process in which the load bearing and transverse bars are heated and joined under pressure.
- D. The grated flooring shall be panelised and sectional for convenient assembly and dismantling generally with bolted joints. The system shall be suitable for flooring walkways, gantries, platforms etc.
- E. Open steel flooring with load bearing bars at 41mm pitch (5mm thick for heavy duty type) with 6mm transverse bars welded at 100mm centres.
- F. Loading Criteria: Heavy Duty.
- F. Complete with system clips, accessories and fixings: Include contrasting (high visibility) nosing bar and toe plate.
- H. Steel Finish: Hot-dip galvanized to EN ISO 1461.

SAFEGRID MESH SIZE OPTIONS	
Load Bearing Bar Centres (A)	Transverse Bar Centres (B)
W (41mm)	50, 100mm
E (33mm)	50, 100mm
N (30mm)	50, 100mm
NX (20mm)	50, 100mm



**Loading Criteria**

BS4592-0:2006 gives minimum design loads for platform and walkways as per the below table.

USE OF PLATFORM OR WALKWAY	UDL	CONCENTRATED LOAD OVER AN AREA OF 300MM x 300MM
Light Duty (1 person)	3.0 kN/m <sup>2</sup>	1.0 kN
General (regular two way pedestrian traffic)	5.0 kN/m <sup>2</sup>	1.0 kN
Heavy duty (high density pedestrian traffic)	7.5 kN/m <sup>2</sup>	1.0 kN

GRA-011 – METAL GRATINGS WITH DURBAR FLOORING PLATE

- A. The Contractor shall install the floor gratings, in accordance with BS 4592-1:2006 'Industrial type flooring and stair treads. Metal open bar gratings. Specification' and including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Floor Gratings shall withstand all loading to include but not be limited to the effects of gravity loads and the applicable loads and stresses under conditions which the Contractor shall determine via establishing the future operational requirements and site surveys.
- C. Provide open steel rectangular pattern flooring, configured to sizes and profiles as indicated on the Drawings, suitably fixed to structural framework system (to Contractor's specification). The flooring shall be constructed from mild steel to EN 10 025 Fe430A and by a forge-welding process in which the load bearing and transverse bars are heated and joined under pressure.

- D. The grated flooring shall be panellised and sectional for convenient assembly and dismantling generally with bolted joints. The system shall be suitable for flooring walkways, gantries, platforms etc.
- E. Flowforge Flowdeck or equivalent open steel flooring with load bearing bars at 41mm pitch (5mm thick for heavy duty type) with 6mm transverse bars welded at 100mm centres. Surface plate of 3mm thick durbar pattern chequer plate welded to the substructure.
- F. Loading Criteria: Heavy Duty.
- G. Complete with system clips, accessories and fixings: Include contrasting (high visibility) nosing bar and toe plate.
- H. Steel Finish: Hot-dip galvanized to EN ISO 1461.

#### GRA-012 – GPR PLATFORMS / WALKWAYS

Comtec GPR grating system. Glass-reinforced plastic (composite) material made of a thermosetting plastic resin and additives reinforced by glass fibres. GPR is chemical and corrosion resistant.

Product reference: Comtec Grating Standard 13mm, 50mm thick panels.

Open Area: 78%

Standard panel size: 3050x1020 mm - bespoke panel size options are available upon request.

Nominal weight: 23.5 kg/sqm

Point Load (Kg/metre @ 1% Deflection): 868kg

UDL (Kg/metre @ 1% Deflection): 1,584kg

Tensile Strength: 220Mpa

Modulus of Elasticity: 21Gpa

Flexural Strength: 280Mpa

Compressive Strength: 145Mpa

Voltage breakdown: 18K volts/mm

Density (Specific Gravity): 2100 kg/m<sup>3</sup>

Thermal Expansion Factor: 13 x 10<sup>-6</sup> mm/mm °C

Water Absorption rate: 0.45 x 24 hrs

Operating Temperature: -100 oC to +200 °C

Flammability resistance :Class 2, Option of Class 2, 1 or Class 0 (BS476 Part 7 & 6)

Anti-Slip Surface: 0.82 CoF (with anti-slip finish)

UV Weather: 5000hrs (ISO 4892-2 Xenon Arc)

Surface: Grit (Silicone Carbide).

Colour finish: Light grey.

Accessories: System fixings and clamps.

Support structure to Engineers specification and detail. Structural fibreglass profiles and assemblies designed to replace steel construction subject to Engineers review and approval.

## 2.0 MATERIALS GENERALLY

Grades of metals, section dimensions and properties, to appropriate British Standards. When not specified, select grades and sections appropriate for the purpose. Prefinished metal may be used if methods of fabrication do not damage or alter appearance of finish, and finish is adequately protected. Fasteners shall be to appropriate British Standards and, unless specified otherwise, of same metal as component being fastened, with matching coating or finish.

## 2.1 STEEL PRODUCTS

- A. STEEL LONG AND FLAT: Hot rolled structural steels (excluding structural hollow sections and tubes): To EN 10025-1. Fine grain steels, including special steels: To EN 10025-3 and -4. Steels with improved atmospheric corrosion resistance: To EN 10025-5.
- B. STEEL PLATE, SHEET AND STRIP: Plates and flats, high yield strength steel: To EN 10025-6.
- C. HOT ROLLED STEEL PLATE, SHEET AND STRIP: Flat products, high yield strength for cold forming: To EN 10149-1, -2 and -3. Carbon steel sheet and strip for cold forming: To EN 10111. Narrow strip, formable steel and steel for general engineering purposes: To BS 1449-1.8 and BS 1449-1.14.
- D. COLD ROLLED STEEL PLATE, SHEET AND STRIP: Steel sections: To EN 10162. Flat products, high yield strength micro-alloyed steels for cold forming: To EN 10268. Carbon steel flat products for cold forming: To EN 10130 and EN 10131. Uncoated carbon steel narrow strip for cold forming: To EN 10139 and EN 10140. Narrow strip steel for general engineering purposes: To EN 10132-1, -2, and -3. Carbon steel flat products for vitreous enamelling: To EN 10209.
- E. COATED STEEL FLAT PRODUCTS: Hot dip zinc coated carbon steel sheet and strip for cold forming: To EN 10346 and EN 10143. Hot dip zinc coated structural steel sheet and strip: To EN 10143 and EN 10346. Hot dip zinc-aluminium (za) coated sheet and strip: To EN 10346.

Hot dip aluminium-zinc (az) coated sheet and strip: To EN 10346. Organic coated flat products: To EN 10169.

- F. STEEL STRUCTURAL HOLLOW SECTIONS (SHS): Non alloy and fine grain steels, hot finished: To EN 10210-1 and -2. Non-alloy and fine grain steels, cold formed welded: To EN 10219-2. Weather resistant steels, hot finished: To BS 7668.
- G. OTHER STEEL SECTIONS: Equal flange tees: To EN 10055. Equal and unequal angles: To EN 10056-1 and -2. Wire, carbon steel for general engineering purposes: To BS 1052. Wire and wire products, general: To EN 10218-2. Tubes: Seamless circular: To EN 10297-1. Seamless cold drawn: To EN 10305-1. Welded and cold sized square and rectangular: To EN 10305-5. Welded circular: To EN 10296-1. Welded cold drawn: To EN 10305-2. Welded cold sized: To EN 10305-3.
- H. STAINLESS STEEL PRODUCTS: Chemical composition and physical properties: To EN 10088-1. Sheet, strip and plate: To EN 10088-2. Semi-finished products bars, rods and sections: To EN 10088-3. Wire: To EN 1088-3. Tubes: Welded circular: To EN 10296-2. Seamless circular: To EN 10297-2.

## 2.2 ALUMINIUM

- A. Aluminium, General: Provide alloy and temper recommended by aluminium producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminium form required.
- B. Designation system, chemical composition and forms: To EN 573-1, -2, -3 and -5. Temper designations: To EN 515. Sheet, strip and plate: To EN 485-1 to -4. Cold drawn rods, bars and tubes: To EN 754-1 and -2. Extruded rods, bars, tubes and profiles: To EN 755-1 and -2. Drawn wire: To EN 1301-1, -2 and -3. Rivet, bolt and screw stock: To BS 1473. Structural sections: To BS 1161.

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminium.
  - 2. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, BS 3692:2014 hex nuts and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; EN ISO 3506-1:2009.
- D. Anchor Bolts: BS 8539:2012, of dimensions indicated; with nuts and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Plain Washers: Round, EN ISO 10673:2009.
- F. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to BS 8539:2012, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Grade 316 stainless-steel bolts, and nuts.

## 2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 mm unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  1. Fabricate toe plates to fit grating units and weld to units in shop unless otherwise indicated.
  2. Fabricate toe plates for attaching in the field.
  3. Toe plate Height: 100 mm unless otherwise indicated.

## 2.5 METAL BAR GRATINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Welded Steel Grating:
  1. Bearing Bar Spacing: As required to comply with structural performance requirements.
  2. Bearing Bar Depth: As required to comply with structural performance requirements.
  3. Bearing Bar Thickness: As required to comply with structural performance requirements.
  4. Crossbar Spacing: As required to comply with structural performance requirements.
  5. Grating Mark: As indicated.
  6. Traffic Surface: As indicated on the drawings.
  7. Steel Finish: Hot-dip galvanized to EN ISO 1461.
- C. Pressure-Locked Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
  1. Bearing Bar Spacing: As required to comply with structural performance requirements.
  2. Bearing Bar Depth: As required to comply with structural performance requirements.
  3. Bearing Bar Thickness: As required to comply with structural performance requirements.
  4. Crossbar Spacing: As required to comply with structural performance requirements.
  5. Grating Mark: As indicated.
  6. Traffic Surface: As indicated on the drawings.
  7. Steel Finish: Hot-dip galvanized to EN ISO 1461.
- H. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
  1. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
  2. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 4.8 mm or less in thickness and spaced 24 mm or more o.c., with each clip designed and fabricated to fit over two bearing bars.
  3. Provide no fewer than four weld lugs for each grating section composed of rectangular bearing bars 4.8 mm or less in thickness and spaced less than 24 mm o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
  4. Provide no fewer than four flange blocks for each section of aluminium I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
  5. Furnish threaded bolts with nuts and washers for securing grating to supports.
  6. Furnish self-drilling fasteners with washers for securing grating to supports.
  7. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
- I. Fabricate cut-outs in grating sections for penetrations indicated. Arrange cut-outs to permit grating removal without disturbing items penetrating gratings.
  1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- J. Do not notch bearing bars at supports to maintain elevation.

## 2.7 EXPANDED-METAL GRATINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work.
- B. Provide expanded-metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
  1. Material: Steel.
  2. Steel Finish: Galvanized.
  3. Stainless-Steel Finish: Mill finish, as fabricated.
  5. Style Designation: As required to comply with structural performance requirements.
  6. Size: As required to comply with structural performance requirements.

7. Type: Expanded and flattened as required to comply with structural performance requirements.
- C. Fabricate cut-outs in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with bars having a thickness not less than overall grating thickness at contact points.
- D. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 3 mm thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

## 2.8 FORMED-METAL PLANK GRATINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work.
- B. C-shaped channels rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.
  1. Channel Width: As required to comply with structural performance requirements.
  2. Channel Depth: As required to comply with structural performance requirements.
  3. Material: Hot-dip galvanized-steel sheet as required to comply with structural performance requirements.
- C. Fabricate cut-outs in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
- D. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 3 mm thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

## 2.9 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Mitre and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
  1. Unless otherwise indicated, fabricate from same basic metal as gratings.
  2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 600 mm o.c. and provide minimum anchor units in the form of steel straps 32 mm wide by 6 mm thick by 200 mm long.
- B. Galvanize steel frames and supports in the following locations:
  1. Exterior where indicated on the drawings.
  2. Interior where indicated on the drawings.

## 2.10 STEEL FINISHES

- A. Comply with BS 4592-1:2006 'Industrial type flooring and stair treads. Metal open bar gratings. Specification', for recommendations for applying and designating finishes.
- B. Finish gratings, frames, and supports after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with EN ISO 1461:2009. Hot dip galvanized coatings on fabricated iron and steel articles.
  1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- D. Shop prime gratings, frames and supports unless otherwise indicated.
  1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- E. Preparation for Shop Priming: Prepare surfaces.

## SECTION 05 53 00

**PART 3 – EXECUTION**

## 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toe plates to gratings by welding at locations indicated.
- F. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- G. Corrosion Protection: Coat concealed surfaces of aluminium that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

## 3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach non removable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

## 3.4 INSTALLING METAL PLANK GRATINGS

- A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
- B. Attach removable units to supporting members by bolting at every point of contact.
- C. Attach non removable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
- D. Attach aluminium units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at mid span.

## 3.5 TOLERANCES

It shall be ensured that in addition to the general requirements of the Specification:

A high degree of accuracy shall be employed in the fabrication of the works and their support structure.

Tolerances for fabrication:

Deviations in panel length, width and diagonal dimension tolerances shall not exceed  $\pm 1$ mm.

The twist and warping shall not cause any point of the panel to be more than 0.5mm out of plane. The twist and warping shall not cause any point of the structural frame to be more than 2mm out of plane.

Tolerances for installation:

The works shall be erected in proper alignment in relation to established lines and grids shown on the Drawings.

Joints: The width of any joint shall not deviate from the nominal width by more than  $\pm 1$ mm. Any variation shall be equally distributed with no sudden changes.

The works shall be erected such that no joint is more than 1.5mm from a vertical plane.

The cumulative slope between the same locations on any vertical plane shall not exceed 1 in 1000. The vertical plane of the works shall be within  $\pm 1.5$ mm of the theoretical position.

Alignment: Adjacent elements of metal floor gratings shall not deviate from either their intended horizontal or vertical alignment by more than  $\pm 2$ mm.

### 3.6 ADJUSTING AND CLEANING

- A. Clean aluminium and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 0.05-mm dry film thickness.
- C. Touch-up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 23 (Painting).
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with EN ISO 1461:2009.

### 3.7 PROTECTION

- A. Protect floor gratings from damage during construction period with temporary protective coverings approved by grating manufacturer. Remove protective coverings at time of Practical Completion.

### 3.8 LIGHTNING PROTECTION & ELECTRICAL CONTINUITY

The design and installation shall ensure electrical continuity and the ability of the assembly(s) to withstand all forces due to a lightning strike in accordance with EN 62305-1:2011 'Protection against lightning. General principles' and BS 7671:2008+A3:2015 'Requirements for Electrical Installations. IET Wiring Regulations'.

Earthing lugs where required shall be located in accessible but inconspicuous places.

### 3.9 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

- 1. Set of 'As Built' drawings and material certification.
- 2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the metal floor grating installation, including all accessories.
- 3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
- 4. Product Technical Data Sheets.
- 5. Installation Method Statement(s) and any agreed revisions.
- 6. Certified copies of each report prepared by the manufacturer's representative(s).
- 7. Warranties: Refer to Clause No's 1.14 & 1.16.
- 8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
- 9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

### 3.10 WASTE

- A. Remove all loose materials, crating and packing materials from the site of installation.
- B. As specified in Waste Management Plan and as follows. Separate waste products from contaminants. Do not include components of pipe and tube railing materials with wood, plastic, or any glass fibre, vinyl, decorative paper, or other finish. Place in designated area and protect from moisture and contamination.
- C. Identify manufacturer's policy for collection or return of remaining unused material and packaging material. Institute demolition and construction recycling to take advantage of manufacturer's programs. When such a service is not available, seek local recyclers to reclaim the materials.

**END OF SECTION 05 53 00**

**SECTION 05 50 00 – METAL FABRICATIONS****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. To be read with the Contract, Drawings, other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

- A. This section describes the design intent for the Contractor's structural design, fabrication, testing, sourcing, finishing, installation and warranting of all manufactured and bespoke metal fabrications for the project, structural supports and concealed fixings for the works as described herein and on the drawings and necessary for the full completion of the works. Test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation to the Employer's Representative approval. To include all items necessary for full completion and finishing of the work not necessarily included.

**1.3 RELATED WORK**

Refer to the Drawings and Finishes Schedules for the associated works related to the miscellaneous metal products specified herein.  
Section 03 53 00 – Concrete Screeds  
Section 04 20 00 – Brick and Block Masonry  
Section 09 29 00 – Gypsum Board Installations  
Section 10 22 20 – Partition Systems

**1.3.1 DEFINITIONS**

- A. Where the word 'Design' occurs in this document it will be described as 'Design\*'. The Asterisk implies that 'Under the design portion requirements of this specification the Contractor is requested to take the design intent and apply their own manufacturers systems and materials performance data to comply with all criteria set out in this specification document and the design intent drawings'.

**1.4 SUMMARY**

This section describes all manufactured and bespoke metal fabrications for the project, structural supports, concealed fixings for the works to include but not be limited to Bollards, Anti-Roost devices, brackets, bolts, fixings and attachments, support pads, copings, louvres, flashings and trims and miscellaneous metal fabrications and components.

**1.4.1 COMPONENT/ELEMENT TYPES**

FAC-001 – FINISHED ALUMINIUM COPINGS  
FAC-002 – JOINTS AND SEALING LAPS  
FMA-001 – PURPOSE MADE COLD FORMED METAL ACCESSORIES  
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SCP-001 – STAINLESS STEEL HEAVY DUTY CORNER PROTECTION  
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STA-001 – GALVANISED METAL STAIRS  
STA-002 – EXTERNAL STAIRWAY TOWERS  
STA-003 – MILD STEEL METAL STAIRS (COATED)  
BSH-001 – BICYCLE/SMOKING SHELTER  
MPR-001 – STEEL MESH PANEL PARTITIONS  
MPR-002 – STEEL MESH SECURITY CAGES  
MPR-003 – PERFORATED STEEL PANELS FOR YARD SCREENS  
MPR-004 – STEEL WELDED MESH PANELS FOR EXTERNAL STAIRS  
BAL-010 – BALUSTRADE INFILL PANELS  
PPR-001 – PERFORATED PANEL PARTITIONS / SCREENS  
SSS-015 – SECONDARY STRUCTURAL STEEL

## 1.5 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT  
Building Regulations 2010

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS  
BRE GROUP  
Green Guide to Specification [www.bre.co.uk/greenguide](http://www.bre.co.uk/greenguide)

BRITISH STANDARDS INSTITUTION

EN 485-2:2008 Aluminium and aluminium alloys. Sheet, strip and plate. Mechanical properties.

EN 754-2:2008 Aluminium and aluminium alloys. Cold drawn rod/bar and tube. Mechanical properties.

EN 755-2:2008 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Mechanical properties.

EN 1991-1-1:2002 Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings. + AMD 15507, Corrigendum February 2010

EN 1999-1-1:2007 Eurocode 9: Design of aluminium structures. General structural rules. + AMD March 2010

BS 1134:2010 Assessment of surface texture - Guidance and general information.

BS 4800:1989 Schedule of paint colours for building purposes.

BS 6180:1999 Barriers in and about buildings. Code of practice. + AMD 13292

BS 6399-1:1996 Loading for buildings. Code of practice for dead and imposed loads. + AMD 13669

BS 8118-2:1991 Structural use of aluminium. Specification for materials, workmanship and protection. + AMD 10486

BS 8300:2009 Design of buildings and their approaches to meet the needs of disabled people. Code of practice. + AMD July 2010

BS 8493:2008 Light reflectance value (LRV) of a surface. Method of test. + AMD March 2010

NA to EN 1991-1-1:2002:2005 UK National Annex to Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings.

NA to EN 1999-1-1:2007:2008 UK National Annex to Eurocode 9: Design of aluminium structures. General structural rules. + AMD March 2010, Corrigendum May 2010

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO/CD 21542:2008 Building construction. Accessibility and usability of built environment. 2008

ROBUST DETAILS LTD  
Robust details handbook.

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)  
Guide Choosing construction products: Guide to the recycled content of mainstream construction products

## 1.6 ACTION SUBMITTALS

- A. Manufacturer's technical product data: Submit Manufacturer's product information, specifications and installation instructions for all miscellaneous metal fabrications to be installed.
- B. All paints, coatings, adhesives, and sealants wet-applied on site must comply with applicable national VOC control regulations, such as the European Deco paint Directive (2004/42/EC).
- C. SHOP DRAWINGS:  
Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
  1. Submit shop drawings to the Employer's Representative showing how the different types of purpose made metal elements are to be constructed, indicating specifically how the requirements of this specification are met.  
Scale shall be not less than 1:20, details at 1:5.  
Plans, sections, elevations and sections as required to fully illustrate the proposals.
  2. Shop drawings must show all planes, elevations, sections and details of fabrication, assembly installation and fixing anchorage for all miscellaneous metal types and conditions. Three-dimensional drawings of typical details will be required.
  3. Details must show and describe metal and material thicknesses, construction and finishes, provision for thermal movements, fabrication and erection tolerances.
  4. The Employer's Representative consideration of drawings submitted by the Contractor shall not in any way relieve the Contractor neither from his responsibility in respect of the accuracy of all such drawings, nor from his responsibility to provide elements suitable in dimensions for the location in which they are to be installed.
  5. The Employer's Representative consideration of detailed specification, method of construction, samples, tests, etc., shall in no way limit or relieve the Contractor from meeting the standards and requirements of this document and the performance specification contained herein.

6. The details shown on the drawings are indicative of the Employer's Representative requirements, i.e. design intent. The method of achieving the construction is the responsibility of the Contractor, provided that it conforms to this specification and tender drawings.
7. Show anchorage and accessory items for each miscellaneous type specified.
- D. **SAMPLES:** Submit samples of item specified, each metal finish for colour and pattern selection, and exposed component hardware.
- E. **Samples:** Submit samples of representative materials, finishes and finished products as required by the Employer's Representative. Samples shall be full size, taken from Manufacturer's stock and complete as required for installation.

#### 1.7 INFORMATION SUBMITTALS

- A. **Product Test Reports:** For all manufactured and bespoke metal fabrications for the project, structural supports and concealed fixings performed by a qualified testing agency. Based on evaluation of comprehensive tests performed by a qualified testing agency, according to NSAI, UKAS.
- B. **Documentation of manufacturer's take-back programme for damaged products, packaging etc.** Include the following:
  1. Appropriate contact information.
  2. Overview of procedures.
  3. Identify manufacturer's policy for collection or return of remaining unused material and packaging material.
  4. Manufacturer's commitment to recycle and/or reuse reclaimed materials and packaging.
  5. Limitations and conditions, if any, applicable to the project.
- C. **Qualification Data:** For qualified professional engineer testing agency.
- D. **Mill Certificates:** Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- E. **Welding certificates.**
- F. **Paint Compatibility Certificates:** From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

#### 1.8 METHOD STATEMENTS

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

#### 1.9 CLOSEOUT SUBMITTALS

- A. Copies of structural design calculations/ test reports.
- B. General product information.
- C. Installation information, to include photographs of structural fixings prior to covering up with finishing work.
- D. Inspection and maintenance reports.
- E. Certification of compliance with the Building Regulations for the purposes of compliance with Building Control (Amendment) Regulations 2014 (S.I. 9).

#### 1.10 MAINTENANCE SUBMITTALS

Submit the following for inclusion in the maintenance manual for the building:

- A. Manufacturer's Instructions
- B. Cleaning Materials and recommended methods of cleaning.
- C. Preventative Maintenance and Inspection recommendations.
- D. Maintenance Instructions.

#### 1.11 QUALITY ASSURANCE

**Manufacturer's Quality System:** Registered to ISO 9001:2015 Quality Standards including in-house engineering for product design activities.

**Fabricator Qualifications:** Furnish references listing projects of similar size and scope.

- A. **FIELD MEASUREMENTS:** Take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of the work. Coordinate fabrication schedule with construction progress to avoid delay of work.
- B. **SHOP ASSEMBLY:** Preassemble items in the shop to greatest extent possible, so as to minimize field splicing and assembly of units at site.
- C. **FABRICATOR'S QUALIFICATIONS:** A firm having a minimum of 5 years successful experience in producing metal fabrications similar to that required for this Project. The fabricator shall be subject to approval of the Engineer.

- D. **INSTALLER'S QUALIFICATIONS:** A firm having a minimum of 5 years successful experience in the installation of metal fabrications similar to that required for this project, and that has been licensed by the Manufacturer of the metal fabrications.
- E. **DURABILITY**  
Selected materials shall be durable and satisfy the requirements of the Specification for the design life of the works.  
The works shall perform throughout its design life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.  
**Accidental Damage/ Robustness:** The works shall comply with the Building Regulations and its associated Technical Guidance / Approved / Approved Documents.  
Metal sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.  
Electro-chemical corrosion or staining resulting from water running from one material to another shall be prevented.
- F. **WIND LOADING**  
Design the works to withstand pressures calculated in accordance with BS 6399: Part 2, to prevent loss of weatherproofing and permanent deformation due to wind pressure or suction. Refer to the Structural Engineer's documentation for wind loads.
- G. **SPECIFIC DEAD LOADS:** The works shall be capable of accommodating the following dead loads without any reduction in performance:
- Self-weight of materials and components.
  - Weight of attached or supported services and building maintenance equipment.
- SPECIFIC LIVE LOADS:** Gauge the selection of aluminium gauge and substrate construction to accommodate the following live loads without any reduction in performance:  
Loads associated with normal maintenance access traffic and in addition any accidental loads imposed by persons falling against or onto the elements.  
Increased weight due to water absorption, snow and ice. Snow loads shall be in accordance with EN 1991-1-3:2003+A1:2015.  
Loads repeatedly imposed by negative and positive wind pressures.  
There shall be no fracture or permanent deformation of any part, nor any deterioration of the subsequent performance of the work resulting from live loads imposed.
- 1.12 **TRANSPORTATION, HANDLING AND STORAGE**
- A. Crate and pack material as required to prevent damage, corrosion and other forms of deterioration. Stack material out of mud and dirt and provide for proper drainage. Exercise care to avoid abrasions and other damage to finish coating. Protect from damage or soiling by adjacent construction operations. Keep material off ground by using pallets, platforms, or other supports.  
Protect material against corrosion and deterioration.
- 1.13 **WARRANTY**
- A. **Manufacturer's standard warranty:** Materials shall be free of defects in material and workmanship for a period of ten years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.
- B. **Manufacturer's Quality System:** Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.
- 1.14 **DECLARATION OF CONFORMANCE**  
The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:
- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
  - The performance requirements for the project.
  - The technical specifications standards described herein.
- 1.15 **SINGLE SOURCE WARRANTY**  
All components and 'build-up of components' shall be covered by a single source, warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified.  
All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions.

Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Employer's Representative.

#### 1.16 PERFORMANCE REQUIREMENTS

- A. The design, supply, installation and finishing of all manufactured and bespoke metal fabrications for the project, structural supports and concealed fixings as shown on the drawings.
- B. The Contractor shall be responsible for all aspects of design, construction, testing, fabrication, detailing and installation to comply with statutory requirements and the requirements of this Specification. This shall include ensuring that all interfacing requirements relating to the building structure are accommodated in accordance with the Employer's Representative's details.
  - 1. The provision of testing data or the carrying out of tests does not relieve the Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.
  - 2. The extent of any damage determined through testing shall be recorded and, where possible, quantified. Details shall be submitted to the Employer's Representative.
  - 3. Details of tests shall be provided to demonstrate the performance of materials and finishes in resisting abrasion from pedestrian traffic (hands, rings, luggage, cloth, shoes, etc.) and any other abrasion resulting from adjacent traffic movements.
- C. Construction shall comply with the visual requirements indicated on the Drawings, and provide a consistent finish to all surfaces.
- D. The Contractor shall undertake the Detailed Design maintaining the function, visual requirements, performance and intent of the Design.
- E. The design and visual character of the project is important and shall be maintained.
- F. Selected materials shall be durable and satisfy the requirements of the Specification for the design life of the works.
- G. The works shall perform throughout its design life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.
- H. Accidental Damage/ Robustness: The works shall comply with Technical Guidance / Approved / Approved Document Part A of the Building Regulations.
- I. Mesh sheets, perforated metal infill panels and infill panels generally shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.
- J. Electro-chemical corrosion or staining resulting from water running from one material to another shall be prevented.
- K. Generally, surfaces shall be sufficiently hard and scratch resistant to resist impacts due to normal maintenance operations without any noticeable change to the surface appearance.

#### 1.17 PROJECT CONDITIONS

- A. FIELD MEASUREMENTS: The Contractor shall verify all actual locations of walls and other construction contiguous with metal fabrications by field/site measurements before commencement of fabrication.
- B. Discrepancies should they occur, shall be reported immediately to the Employer's Representative.

#### 1.18 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages (where necessary) for manufactured and bespoke metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support manufactured and bespoke metal fabrications temporarily by any means that do not satisfy structural performance requirements.

#### 1.19 STRUCTURAL REQUIREMENTS

- A. LOADING ASSUMPTIONS

All manufactured and bespoke metal fabrications are to be designed to the requirements of IS EN 1991-1-1: General Actions – Densities, self-weight, imposed loads for buildings and its National Annex as they relate to this classification.

**B. SPECIFIC MOVEMENT**

1. The specialist Contractor shall take into account all differential movements with the collective structures and allow for appropriate movement joints with all manufactured and bespoke metal fabrications, extrusion profiles etc.
2. All fixings shall be capable of providing adequate adjustment with the minimal use of packing shims.
3. All necessary movement joints shall be designed to accommodate the maximum movements that can be derived from the specified and determined design loads and movements. Under maximum movements the joints shall meet the requirements of the Specification.
4. The works shall resist all specified static and dynamic design loads likely to be encountered without causing permanent deformation of components or the failure of members or seals and shall transmit such loads safely to the points of support.  
The works shall not deflect under loading in any way that is detrimental to any elements the works or adjacent structural or building elements.  
The works shall accommodate the following movements without any permanent deformation or reduction in the specified performance:
  - Deflection under design loads.
  - The effects of internal/ external wind and pressure loadings.
  - Changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.
  - Movement of any joint whether designed to permit movement or not.

**C. THERMAL MOVEMENTS: DEFLECTION**

1. The works shall not deflect under loading in any way that is detrimental to any element of themselves or adjacent structural or building elements.
2. All components, couplings and fixings shall be capable of accommodating all of the above deflection without permanent distortion, deformation or failure.
3. The works shall accommodate differential structural movements arising from any loads imposed by adjacent structures.
2. The magnitude of the allowable deflections shall be reduced if they are detrimental to any part of the works, their support structure or internal finishes.

**1.20 CONTRACTOR'S ENGINEER OF RECORD**

The Contractor's Engineer of Record must be currently licensed within the jurisdiction of the project.

The Engineer of Record must be approved, authorized, and currently licensed by the Institution of Engineers of Ireland (IEI), and have a minimum of five years' experience as an approved Engineer.

The Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. The Engineer of Record must provide certified engineering calculations for: manufactured and bespoke metal fabrications for the project, structural supports and concealed fixings and associated requirements in accordance with UK and European codes.

**1.21 LIGHT REFLECTANCE VALUES AND THE REQUIREMENTS OF PART M APPROVED DOCUMENT**

In accordance with the requirements of Building Regulations 2010, APPROVED DOCUMENT, Part M Access and Use and BS 8300:2009 +A1:2010 the following applies to the LRVs of the surface finishes:

Differences in LRV shall be used to assess the degree of visual contrast between surfaces such as floors, walls, doors and ceilings and between key fittings/fixtures and surrounding surfaces, and

The LRV of a wall shall be 30 points different from that of the ceiling and of the floor.

To avoid giving the wrong impression about the size of a room, skirtings shall have the same LRV as the wall so that the junction between the skirting and the floor marks the extent of the room.

Refer to the Employer's Representative for colour selections of walls, ceilings, joinery etc. All to be selected from the coating manufacturer's full range of RAL and/or BS colours.

**1.22 PARTITIONS TO SUPPORT BOTH LIGHT AND HEAVY WEIGHT ANCHORAGES**

To conform with the requirements of Table 3, 'Summary of Tests for Crowd Pressure, Lightweight Anchorages and Heavyweight Anchorages' of BS 5234 Partitions.

The partitions against which elements are to be mounted/hung are to be constructed in accordance with 'Heavyweight Anchorages' as detailed in the requirements of Table 3, 'Summary of Tests for Crowd Pressure, Lightweight Anchorages and Heavyweight Anchorages' of BS 5234 1992 Partitions.

The Contractor is to ensure that all necessary noggins and fixing grounds are provided to provide adequate support structure for all wall fixed cupboards and to meet the loading requirements for 'Heavyweight Anchorages' with particular reference to wall hung items generally and wall hung items mounted at a height.

#### 1.23 MANUFACTURER(S) PROVISION OF ON SITE TRAINING

The product manufacturer is to provide 'toolbox talks' on site, on appropriate installation and fixing requirements for all products to be installed.

The Contractor shall demonstrate that each manufacturer has visited site and provided Instruction on correct application for each type specified.

Inspections: Manufacturer(s) to inspect installation of each product type (frequency of such site visits to be agreed with the Employer's Representative and the Client's Representative) to ensure appropriate and correct installation(s) and complete an inspection report for each visit.

Verification: The manufacturer(s) to verify correct installation of each product type.

Warranty: Manufacturer(s) to provide Project Specific Performance Warranty upon completion of the installation of the installed product types.

The Employer's Representative will not accept installations / applications of products which have not been approved by their respective manufacturer(s).

#### 1.24 TESTING REQUIREMENTS

The Contractor shall include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

The provision of testing data or the carrying-out of tests does not relieve the Contractor of his responsibilities regarding the performance requirements, quality of application, durability or service life requirements, etc.

#### 1.25 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed with a maintenance free life in excess of 20 years. Within the period of 'maintenance free life' the assembly shall perform at or above the levels specified elsewhere. In accordance with BS ISO 15686-5:2008 'Buildings and constructed assets. Service life planning. Life cycle costing'.
- B. The term 'Maintenance' shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.
- D. COMPONENT PARTS: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Employer's Representative must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.
- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.26 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  1. ISO 14001 Environmental Management Systems certification.
  2. Validation according to the Eco-Management and Audit System (EMAS).
  3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. All manufactured and bespoke metal fabrications for the project, structural supports and concealed fixings as designed, supplied and installed by a manufacturer regularly engaged in the design and production of such systems.

- C. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work to include but not to be limited to, the following:

Barricade Ltd., Unit 6 Conway Industrial House, Wigan, Lancashire WN6 9DW, UK  
Tel.: +44 (0)845 9002131. Email: info@barricade.co.uk. www.barricade.co.uk

Graepel Perforators & Weavers Ltd., Barrack Green, P17 FE80 Kinsale, Co. Cork  
Tel.: +353 (0) 21 4772105. Email: sales@graepel.ie. www.graepel.ie

Peterson Manufacturing Ltd, Unit 211-213 Holly Road, Western Industrial Estate, Dublin 12  
Tel: +353 (0)1 4600112. Email: info@petersonmfg.ie. www.petersonmfg.ie

Marshalls PLC, Landscape House, Lowfield Business Park, Elland HX5 9HT, UK  
Tel.: +44 (0)3300574472. Email: info@marshalls.co.uk. www.marshalls.co.uk

Falco, Barnfield Close, Barnfield Ind. Estate, Leek Staffordshire ST13 5EG, UK.  
Tel: +353 (0)1538 380080. Email: sales@falco.co.uk. www.falco.co.uk

Troax (UK) Ltd, Enterprise House, Murdock Road, Dorcan, Swindon, Wiltshire, SN3 5HY, UK.  
Tel: +44 (0)1793 542000. Email: info.uk@troax.com. www.troax.com/gb

## SECTION 05 50 00

**PART 2 – PRODUCTS**FAC-001 – FINISHED ALUMINIUM COPINGS

- A. Finished aluminium parapet and louvres copings with PPC finish. Aluminium copings to parapet walls as indicated on the Drawings.
- B. Capping system: Pressed PPC finished, aluminium parapet copings, forming copings with butt straps to parapets, as shown on the drawings - to sizes and profiles indicated on the Drawings to include as standard on all parapet copings, anti-drumming insulation and all concealed fixings, supports, framing, seals, sealants and other accessories / components necessary to complete the works.  
Finish: Polyester powder coated aluminium.
- C. Parapet Coping Thickness: nominally 3mm thick metal not including anti-drumming insulation (which is to be provided).
- D. Dimensions: refer to the drawings for the dimensions and profiles.  
Lengths: refer to the drawings for the dimensions and profiles.
- E. Fixing: Sleeved. All methods of fixing to be concealed, details to be agreed.  
Finish: PPC minimum of 60 microns, average 65 microns thickness. Colour to match wall cladding panels. To be confirmed with the Employer's Representative via samples.
- F. Sealant:  
Single-component or multicomponent elastomeric type conforming to ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Provide a sealant that has been tested on the types of substrate to which it will be applied.
- G. Electrical continuity shall be achieved between conductive parts. Provisions shall be made for lightning protection integration requirements.
- H. Allowance shall be made for coping spanning building movement joints. Expansion and movement joints shall accommodate the appropriate range of movement. Refer to, and take account of the Structural Engineer's Movements and Tolerances information as defined within the SE's Documentation.

FAC-002 – JOINTS AND SEALING LAPS

- A. All joints in flat aluminium components / elements in the horizontal and vertical planes are to be sleeved and have a flat aluminium liner piece behind extending the full length of the joint and to extend a minimum of 75mm to each side of the joint.
- B. All joints are to be weather and water proof and to be complete with gasketed sealing.
- C. There are to be no random joints in aluminium components. All joints are to be anticipated and to be designed to comply with the modular grid and the configuration established to the Employer's Representative approval.
- D. The position of sealing laps shall be in straight, unbroken lines immediately below fixing positions and parallel to the edges of sheets. They shall be placed into corrugations, as appropriate and not allowed to stretch or sag in position.
- E. Ensure continuity and effectiveness of seal, especially at the corners of the sheets.  
Do not over compress.  
Sealant type(s) shall be recommended for the purpose by the sheet manufacturer.

FMA-001 – PURPOSE MADE COLD FORMED METAL ACCESSORIES

- A. Copings, closure pieces, flashings, trims, sills, fillers, spacers, tapes, sealants, fixings, etc., where not specified, shall be types recommended in writing by the manufacturer and as agreed with the Employer's Representative.
- B. The material shall be finished aluminium to match finished aluminium facade components or to the Employer's Representative approval via samples.
- C. The aluminium thickness/ gauge shall be a minimum of 3 mm.  
The finish/ colour shall be finished as the aluminium components of the facade.
- D. There are to be no random joints in aluminium components. All joints are to be anticipated and to be designed to comply with the modular grid and the configuration established to the Employer's Representative approval.
- E. All accessories shall be fixed in accordance with the manufacturer's recommendations.

SAC-001 – STATIC INTERNAL STEEL BOLLARDS

N/A - - Refer to Civil design pack for bollard requirements.

SAC-002 – STATIC STEEL BOLLARDS

N/A – Refer to Civil design pack for external bollard requirements.

SAC-003 – SOCKET STEEL BOLLARDS

N/A – Refer to Civil design pack for external bollard requirements.

SAC-004– CONCRETE-FILLED STEEL BOLLARDS

N/A – Refer to Civil design pack for external bollard requirements.

SCP-001 – STAINLESS STEEL HEAVY DUTY CORNER PROTECTION

To service areas and service link corridors.

Manufacturer must be in possession of a valid quality systems certificate, showing compliance with EN ISO 9001:2000.

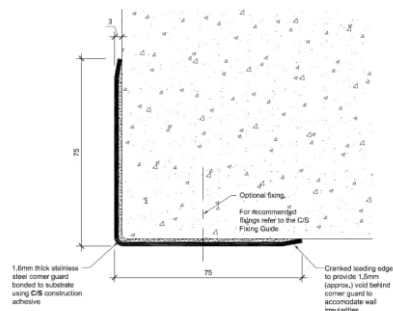
Description: Stainless Steel 75 x 75 x 2000mm @ 90° Corner protection 2000mm AFFL, corner protection angles, complete with top and end caps.

The heavy duty corner protectors will incorporate impact cushions for extra resilience.

From the manufacturer's full colour range and shall be agreed with the Employer's Representative via samples.

Fixing: Concealed screw fixing to fixing grounds within stud partition or adhesively fixed to the substrate, in accordance with the manufacturer's written product data.

Locations: All external corners as shown on the Drawings.



INDICATIVE IMAGE OF REQUIREMENT FOR CORNER PROTECTION

CPB-001 – CAR PARK VEHICLE BARRIER WITH FLEXI POST SYSTEM

N/A

STA-001 – GALVANISED METAL STAIRS

Component material, grade and finish as delivered:

- General: Staircases, landings and associated balustrades and handrails to be designed to BS5395-1:2000. For stair loadings refer to Structural Engineer's drawings and specifications. Mild steel structure to stair as indicated on the design drawings. All steel section sizes to be subject to Subcontractor design proposals to the specified loading criteria, and of no larger cross-sectional area that indicated in the design drawings (unless with Architect approval). Connections back to primary structure at head, landings and base of stair to Contractors proposals with reference to Structural Engineer's drawings and specifications.
- Component materials/ grades: All MS sections to be sized by Subcontractor for onsite erection and assembly. Consideration of pre-fabrication of components to be made.
- Treads: DDA durbar, mild steel folded plate treads welded at joints between adjacent treads. Plate thickness to be confirmed by Subcontractor. Tread assembly subject to proposal by Subcontractor.  
Slip resistance value of integral tread - water wet (minimum): PTV of 40 to BS 7976.  
Slip resistance value of integral nosing - water wet (minimum): PTV of 40 to BS 7976.

Colour of integral nosing: LRV to BS 8493 contrast of 30 (minimum) with tread. Submit proposals.

Risers: DDA durbar as part of tread component.

Alternative treads: Galvanised steel grating – Refer to GRA-010 in Section 05 53 00 (Metal Gratings).

- Strings: MS plate to EN 10025, as indicated on FCBS drawings. Steel structure for stairs subject to Subcontractor proposal.
- Guarding: Refer to Section 05 52 13 (Pipe and Tube railings), BAL-006.
- Finish as delivered: Galvanized to EN ISO 1461.

Note requirements on drawings for interfaces with existing fabric, proposed structural connections, integrated landings and stringer formed kick plates.

Joints welded and ground smooth. Bolted connections to be fully recessed where exposed.

#### STA-002 – EXTERNAL STAIRWAY TOWERS

N/A

#### STA-003 – MILD STEEL METAL STAIRS (COATED)

Component material, grade and finish as delivered:

- General: Staircases, landings and associated balustrades and handrails to be designed to BS5395-

1:2000. For stair loadings refer to Structural Engineer's drawings and specifications.

Mild steel structure to stair as indicated on the design drawings. All steel section sizes to be subject to Subcontractor design proposals to the specified loading criteria, and of no larger cross-sectional area that indicated in the design drawings (unless with Architect approval).

Connections back to primary structure at head, landings and base of stair to Contractors proposals with reference to Structural Engineer's drawings and specifications.

- Component materials/ grades: All MS sections to be sized by Subcontractor for onsite erection and assembly. Consideration of pre-fabrication of components to be made.
- Treads: DDA durbar, mild steel folded plate treads welded at joints between adjacent treads. Plate thickness to be confirmed by Subcontractor. Tread assembly subject to proposal by Subcontractor.

Slip resistance value of integral tread - water wet (minimum): PTV of 40 to BS 7976.

Slip resistance value of integral nosing - water wet (minimum): PTV of 40 to BS 7976.

Colour of integral nosing: LRV to BS 8493 contrast of 30 (minimum) with tread. Submit proposals.

Risers: DDA durbar as part of tread component.

- Strings: MS plate to EN 10025, as indicated on FCBS drawings. Steel structure for stairs subject to Subcontractor proposal.
- Guarding: Refer to Section 05 52 13 (Pipe and Tube railings), BAL-006.
- Finish as delivered: Galvanised and polyester powder coated.

Note requirements on drawings for interfaces with existing fabric, proposed structural connections, integrated landings and stringer formed kick plates.

Joints welded and ground smooth. Bolted connections to be fully recessed where exposed.

#### BSH-001 – BICYCLE/SMOKING SHELTER

Stand alone, bolt down, steel frame and roof bicycle and smoking shelter construction.

- Product Reference: Glasdon UK Ltd or equivalent – Echelon Cycle Shelter.
- Material:
  - Frame: Structural grade carbon steel, galvanized and polyester powder coated.
  - Cladding: Clear, curved polycarbonate back panel and end panels.
- Finish: Polyester Powdercoat to selected RAL colour.
- Capacity: Min. 10 No. cycles.
- Accessories: Root Fix Stands are cast into concrete below ground.
- Installation: To manufacturer's instructions. Foundation and fixing detail to be submitted for Structural Engineers' approval.

#### MPR-001 – STEEL MESH PANEL PARTITIONS

Location: Refer to drawings.

Partition reference: PT-11

Component material, grade and finish as delivered:

Bespoke galvanised mild steel partition with mesh infill panels.

Reference Manufacturer: Peterson Manufacturing Ltd.

- Mild steel structure to partitions spanning floor to soffit and as indicated on the design drawings. All steel section sizes to be subject to Subcontractor design proposals to the specified loading criteria, and of no larger cross-sectional area that indicated in the design

drawings (unless with Architect approval). Note requirements on drawings for interfaces with existing fabric and proposed structural connections. Connections back to primary structure with reference to Structural Engineer's drawings and specifications.

- Component materials/ grades: All MS sections to be sized by Subcontractor for onsite erection and assembly. Consideration of pre-fabrication of components to be made.
- Mesh: 12.7mmx12.7mm centre to centre x 3.5mm (10 gauge) square woven wire welded to steel frame. Nominal free area 46.1%.
- Panels: 32mm x 32mm x 5mm steel angle frame. Mesh is welded to frame with flat steel stiffeners welded to frame behind mesh panels as required for support.
- Doors: 32mm x 32mm x 5mm steel angle frame. Mesh is welded to frame with flat steel stiffeners welded to frame for extra strength as required to prevent racking. The doors shall be prepped for installation of an electric lockset, power transfer hinge and overhead door closer. A secured raceway and mounting plate shall also be provided for installation of a card reader when mounting on an adjacent partition is not possible due to equipment obstructions. The number of hinges shall be determined by the door weight but shall not be less than 3 total.
- Posts: 50mm x 50mm x 3mm (14 gauge) square tubing with welded base plate as a minimum. Post properties and dimensions shall be determined by a certified engineer based upon the actual field conditions.
- Hardware: Manufacturer's standard erection hardware and anchor bolts. All hardware shall be upgraded if required based on field conditions and engineering calculations.
- Finish: Galvanized and polyester powder-coated to RAL 9005 Black.
- Joints welded and ground smooth.
- Accessories: Permanent security sleeve anchors, fixings and rivets to supplier's design.

MPR-002 – STEEL MESH SECURITY CAGES

N/A

MPR-003 – PERFORATED STEEL PANELS FOR YARD SCREENS


Location: Refer to drawings.

Component material, grade and finish as delivered:


Bespoke galvanised mild steel screens with pre-galvanised expanded steel infill panels.

Product Reference Manufacturer: Graepel TM 336R Expanded Mesh (raised expanded mild steel mesh).

- Mild steel frame structure as indicated on the design drawings. All steel section sizes to be subject to Subcontractor design proposals to the specified loading criteria, and of no larger cross-sectional area that indicated in the design drawings (unless with Architect approval). Note requirements on drawings for interfaces with building fabric and proposed structural connections. Connections back to primary structure with reference to Structural Engineer's drawings and specifications.
- Component materials/ grades: All MS sections to be sized by Subcontractor for onsite erection and assembly. Consideration of pre-fabrication of components to be made.
- Pre-galvanised expanded steel mesh welded to steel frame.
- Mesh opening size: 85.7x40.6mm. Nominal free area 84%.
- Mesh panel thickness: 3 mm
- Mesh panel weight: 3.7 kg/m<sup>2</sup>
- Finish as delivered: Galvanized and polyester powder-coated to RAL colour as per design drawings.
- Joints welded and ground smooth.
- Accessories: Anchors, fixings and rivets to supplier's design.
- Note: All fixings to be internal (secure) side and not visible from external side of screen.

**Expanded Mesh** 

Reference	W	SP	Mesh	Thick	Weight	Open area
Number	mm	mm	mm	kg/m <sup>2</sup>	% of area	
TM 020R	5.8	3.5	0.8	0.6	2.1	44%
TM 070R	7.6	4.8	1.2	1.0	3.4	55%
TM 124R	10.5	11.7	2.4	1.6	4.9	62%
TM 126R	10.5	11.7	2.4	1.2	3.8	61%
TM 137R	13.0	15.5	2.2	1.6	5.4	76%
TM 201R	16.5	19.5	2.5	2.5	4.4	77%
TM 203R	16.5	19.5	2.5	2.5	4.4	77%
TM 203R	50.8	22.3	3.0	1.6	3.4	80%
TM 208R	50.8	22.3	3.0	3.0	8.1	69%
TM 208R	101.6	22.5	3.1	3.0	6.9	70%
TM 302R	16.5	19.5	3.5	3.0	4.9	78%
TM 336R	85.7	40.6	3.2	3.0	3.7	84%
TM 407R	101.6	50.8	3.0	3.0	4.7	82%
TM 407R	101.6	50.8	3.4	3.0	5.1	85%
TM 459R	101.6	50.8	4.6	3.0	5.4	82%
TM 000R	200.0	75.0	6.3	3.0	3.6	



Light flattened mesh  
EXPANDED MESH

**MPR-004 – STEEL WELDED MESH PANELS FOR EXTERNAL STAIRS**

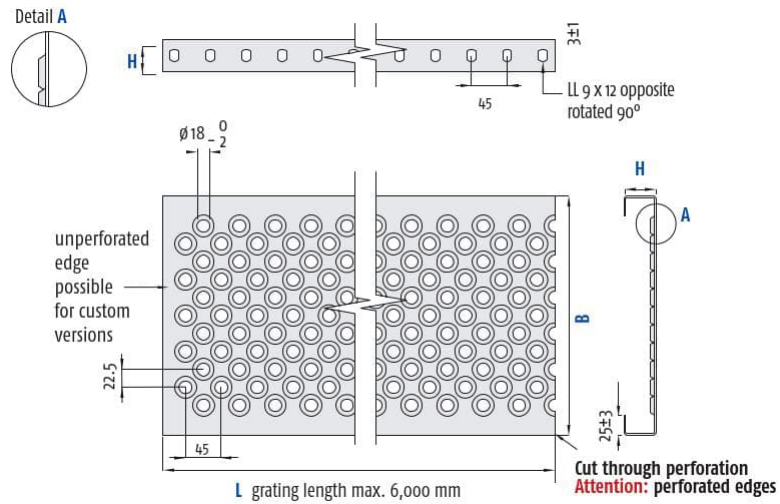
Location: Refer to drawings.

Component material, grade and finish as delivered:

Bespoke galvanised mild steel screens with pre-galvanised steel welded mesh infill panels.

Product Reference Manufacturer: Graepel-Glide 18 steel welded mesh panels.

- Galvanised steel frame structure as indicated on the design drawings. All steel section sizes and supporting framework to be subject to Subcontractor design proposals to the specified loading criteria, and of no larger cross-sectional area that indicated in the design drawings (unless with Architect approval). Note requirements on drawings for interfaces with building fabric and proposed structural connections. Connections back to primary structure with reference to Structural Engineer's drawings and specifications.
- Component materials/ grades: All steel sections to be sized by Subcontractor for onsite erection and assembly. Consideration of pre-fabrication of components to be made.
- Pre-galvanised expanded steel mesh panels welded to steel frame.
- Preforation opening size: 18mm diameter.
- Panel thickness: 2.5mm.
- Panel length: up to 6000mm.
- Panel depth: H = 50mm.
- Panel width: Varies between 182mm, 240mm, 298mm as indicated on design drawings.
- Panel weight: Supplier to confirm.



- Finish as delivered: Galvanized and polyester powder-coated to RAL colour as per design drawings.
- Joints welded and ground smooth.
- Accessories: Anchors, fixings and rivets to supplier's design.
- Note: All fixings to be internal (secure) side and not visible from external side of screen.
- Design intent images:



PPR-001 – PERFORATED PANEL PARTITIONS / SCREENS

Component material, grade and finish as delivered:

Bespoke polyester powder coated mild steel partition with perforated infill panels.

Reference Manufacturer: Cross-Guard.

- Mild steel structure to partitions as indicated on the design drawings. All steel section sizes to be subject to Subcontractor design proposals to the specified loading criteria, and of no larger cross-sectional area that indicated in the design drawings (unless with Architect approval). Note requirements on drawings for interfaces with existing fabric and proposed structural connections. Connections back to primary structure with reference to Structural Engineer's drawings and specifications.
- Component materials/ grades: All MS sections to be sized by Subcontractor for onsite erection and assembly. Consideration of pre-fabrication of components to be made.
- Steel sheet: 5 mm thick. 50mm square perforations at 45° angle with. Nominal free area 50%.
- Design: as per CSA drawings. Maximum height: 8m
- Steel doorsets: Integrated, supplied by system manufacturer.
- Finish as delivered: Polyester powder-coated to RAL 9005 Black.
- Joints welded and ground smooth.
- Accessories: Permanent security sleeve anchors, fixings and rivets to supplier's design.
- Ironmongery: Allow for integration of Abloy EL461 electric lock system, including accessories and connections, Abloy Inoxi 3-19/013 PZ+BL lever handles, GEZE TS 4000 self-closer, ALP135 Surface-mounted door loop.

BAL-010 – BALUSTRADE INFILL PANELS

Component material, grade and finish as delivered:

Galvanised and polyester powder coated mild steel infill panels.

Panels: 2mm mild steel sheet

Fixings: Proprietary cast or formed metal Kee-Klump fixing flanges. Bolted fixing.

Finish: Galvanised and polyester powder coated to RAL 7035 Light grey.

Edges: Bevelled/rounded and polished smooth.

To be read in conjunction with Section 05 52 13 Clause BAL-003 – GALVANISED STEEL BALUSTRADE – KEE-KLAMP SYSTEM

SSS-015 – SECONDARY STRUCTURAL STEEL

There is a requirement for secondary structural steel throughout the project. The requirement for secondary steel shall include but not be limited to 'goal posts' to support double or oversized / heavy doorsets, lintels to support glazed partition systems, 'in partition' steel support for a variety of large / oversized wall mounted items, and wall mounted grab and hand rails in washroom facilities etc.

The support system shall comprise of secondary steel to Contractor's design, comprising:

Square box section galvanised mild steel at centres and lengths to form goal posts / lintels with mild steel plates welded to section with predrilled holes for fixing to RC concrete soffit and floor. All predrilling, welding and finishing of welds to be completed prior to galvanising the steel. The steel structure shall be lined with structural gypsum board to provide for variation in the fixing attachments to the structure and additional stability.

The equipment / components shall be attached to the support goal posts, lintels and partitions as recommended by the equipment manufacturer to give the necessary support and integrity for the elements to be supported.

Fixing system as agreed with the Employer's Representative.

## 2.1 MATERIALS

- A. General: Material shall conform to the requirements specified for the particular item(s), and where these requirements are not specified in detail, the material shall be suitable for the intended use, and as approved by the Engineer.
- B. Metal Surfaces: For fabrication of miscellaneous metal work which shall be exposed to view, materials shall be smooth and free of surface blemishes such as pittings, seam marks, roller marks, rolled trade names, and roughness.
- C. ALUMINIUM COPINGS:  
The aluminium shall be capable of withstanding atmospheric conditions pertinent to the location of installation and authenticated test certificates from the manufacturer shall be provided to confirm compliance.  
Aluminium copings shall be sufficiently thick to provide a visually flat surface and to eliminate distortion and permanent deformation caused by solar radiation.  
Joints in copings and trims shall be installed to fully accommodate thermal movement.

Coping joints generally shall comply with the Cladding Manufacturer's recommendations, and recommendations contained within the - 'Profiled Sheet Metal Roof and Cladding, A Guide to Good Practice' 2nd Edition or as otherwise stated.

Copings shall include all necessary anti-drumming insulation.

Electrical continuity shall be achieved between conductive parts. Provisions shall be made for lightning protection integration requirements.

D. FIXINGS:

Fixing components shall comply with all statutory requirements (and be to the acceptance of the Structural Engineer) both as to strength and type and shall be designed to carry all dead, live and wind loading under due consideration of any applicable thermal movements. Select suitable components and fixings in accordance with the following:

All sheet mild steel, cleats, angles, fixing brackets, etc. used in the fixing assemblies shall comply with BS 7668, BS EN 10029, BS EN 10025: Parts 1-4 and 6 and rolled sections shall be used wherever practicable or appropriate. Steel sections used shall be hot-dip galvanised to the requirements of BS EN ISO 1461 after all cutting, drilling of holes and welding has been completed.

Stainless steel fixing components for the works shall comprise components of high grade austenitic stainless steel exterior quality to EN 10088, EN 10084, EN 10087, EN 10095, EN 10048, EN 10051, EN 10250: Part 4 and EN ISO 9445 and BS 8298.

All non-visible supporting aluminium sub-constructions shall be corrosion protected.

Mill finished aluminium shall not be used.

Aluminium sub-constructions shall be separated from concrete by bitumen paint or similar acceptable method. Austenitic stainless steel to EN 10088 may be used in lieu of aluminium for any supporting sub-constructions.

Fixing bolts, nuts, screws, washers, etc. shall be manufactured from austenitic stainless steel complying with EN ISO 3506: Parts 1 and 2. All screw fixings and attachments shall be secured against vibrating loose.

General: Provide appropriate fasteners for exterior use or where built into exterior walls. Select the fasteners for the type, grade and class required. Ensure when selecting fixings that bi-metallic corrosion will not occur as a result of two dissimilar metals being placed in 'electrical' contact and bridged by an electrically conductive liquid.

## 2.2 FABRICATED ITEMS

- A. General: Use materials of size and thickness indicated on Drawings. Where not indicated, use sizes and thickness required to achieve strength and durability in finished product. Work to the dimensions indicated or approved on shop drawings, using proven details of fabrication and support. Fabrication shall be done in shop to fullest extent as possible with only assembly and installation works to be done on site.
- B. Form exposed work to the lines and levels with accurate angles and surfaces and straight sharp edges. Form the bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

## 2.3 FABRICATION

- A. Shop fabricate metal fabrication units as far as practicable. Use materials of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop Drawings using proven details of fabrication and support. Use the type of materials shown or specified for the various components of work.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Ease exposed edges to a radius of approximately 1 mm unless otherwise shown.
- D. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.
- E. Weld corners and seam continuously and in accordance with the recommendations of 'Profiled Sheet Metal Roof and Cladding, A Guide to Good Practice' 2nd Edition. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- F. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use flathead screws or bolts.
- G. Provide for anchorage of the type shown, coordinated with the supporting structure and the progress schedule. Fabricate and space anchoring devices to provide adequate support for the intended use of the work.
- H. Cut, reinforce, drill and tap metal fabrications indicated to receive finish hardware and similar items of work.

1. Exposed fastenings: Compatible materials, generally matching in colour and finish, and shall harmonize with the material to which fastenings are applied.
2. Provide the necessary rebates, lugs and brackets to assemble the work in a neat and substantial manner. Turn edges of flanged items to form plaster keys where plaster occurs. Drill and/or punch holes for bolts and screws. Conceal fastening where practical.
3. Provide thickness of metal and details of assembly or supports to give ample strength and stiffness. Form joints exposed to weather in a way to exclude water.
4. Where dissimilar metals are in contact, or where aluminium is in contact with concrete, mortar, masonry, wet or pressure-treated wood or absorptive materials subject to wetting, protect the surfaces with a coat of bituminous paint, unless otherwise specified, to prevent galvanic or corrosive action.

## SECTION 05 50 00

**PART 3 – EXECUTION**

## 3.1 INSPECTION

- A. Examine the areas and conditions under which metal fabrication items are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Coordinate setting Drawings, diagrams, templates, instructions and directions for installation of anchorage such as concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the affected trades for installation.
- B. Take field measurements prior to fabrication and delivery of metal fabrications to ensure proper fit of work.
- C. Apply bituminous mastic coating to concealed surfaces of metal fabrications where metal will be in contact with dissimilar material, set in concrete or masonry, and potentially damp conditions to prevent corrosion of metal.

## 3.3 INSTALLATION

- A. Install units to allow for expansion and contraction from a minimum ambient temperature range of 0 - 49 degree C without causing deformation of units and over-stress of welds and fasteners.
- B. Set metal fabrications accurately in locations, alignments and elevations shown, plumb, level, true and free of rack, measured from established lines and levels.
- C. Fastening to In-place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrication items to in-place construction including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, wood screws and other connectors as required.
- D. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
- E. Cutting and Fitting:
  - 1. Perform cutting, drilling, welding and fitting required for the installation of the metal fabrications.
  - 2. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coats.
  - 3. Do not weld, cut or abrade exposed surfaces which cannot be completely restored in the field.
  - 4. Drill holes for bolts and screws. Conceal fasteners where possible. Mill exposed ends and edges smooth, with corners slightly rounded.
- F. Field Welding: Conform to 'Profiled Sheet Metal Roof and Cladding, A Guide to Good Practice' 2nd Edition for procedures of manual shielded metal-arc welding, appearance and quality of welds made and methods used in correcting welding work.
- G. Soldering: Conform to the recommendations of 'Profiled Sheet Metal Roof and Cladding, A Guide to Good Practice' 2nd Edition. Use only for filling or sealing joints and not for mechanical strength. Where exposed to view, soldered joints shall be finished to match adjoining finish metal and made as unnoticeable as practicable.
- H. Sharp metal edges: Fold under or remove as work proceeds.

## 3.4 WORKMANSHIP

- A. The works shall be erected plumb (or at the angles prescribed) and true in proper alignment and relation to established lines and grids as shown on the Working Drawings. The erected system shall present true and accurate lines and flat planes. Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length with a rate of exchange not exceeding 1:1000, of 3mm. All the above shall be measured from a laser reference line.
- B. Level: The works shall be within  $\pm 2\text{mm}$  of the specified level. The cumulative slope between the same locations on any horizontal plane shall not exceed 1 in 1000.
- C. Plumbness: The works shall be erected such that no point on any panel is more than 3mm from its theoretical vertical/ diagonal plane. The cumulative slope between the same locations on any element shall not exceed 1 in 1000.
- D. The vertical plane shall be within  $\pm 2\text{mm}$  of the theoretical plane position.  
A method statement detailing proposals to achieve the specified tolerances shall be submitted with the Tender. This shall demonstrate a clear understanding of the construction programme, the effects of the building structure and construction method and the fabrication method of the panels. Sufficient analysis of the erection sequence shall be undertaken to ensure that the installation tolerances stated above shall be met to the acceptance of the

Employer's Representative. Dimensional Checking: Before work begins on Site the proposed method of dimensional setting-out and crosschecking with adjacent trades and elements to satisfy the accuracy requirements shall be submitted to the Employer's Representative. The checking of any setting-out or of any line or level by the Employer's Representative, or his representative, shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

- E. Alternative Tolerances: Alternative tolerances to those specified may be permitted at the Employer's Representative discretion, provided they are agreed in advance of manufacture of components. The Working Drawings shall provide for sufficient tolerance in manufacture of the works in order to accommodate manufacturing tolerances of interfacing elements. The tolerances stated herein shall be adhered to. No revisions to the tolerances to cater for inadequate control shall be permitted. Full details shall be submitted to the Employer's Representative for review of the proposed methods for achieving and constantly monitoring the fabrication tolerances during all stages of the work. Detailed records of constant control and tolerances achieved shall be submitted to the Employer's Representative. The works, when installed, shall not be subject to warping or twisting and shall be strictly rigid, firm, free from vibration, knocking, rattles, squeaks and other noises when subject to the worst combination of environmental conditions and wind loads.
- F. All tolerances stated shall be measured and monitored at a mean temperature to be agreed with the Employer's Representative.

### 3.5 PROTECTION

- A. Protect all installed metal fabrications and finishes, including those of copings stainless steel components and bollards from damage during construction period with temporary protective coverings approved by manufacturer(s). Remove protective coverings at time of Practical Completion.

### 3.6 LIGHTNING PROTECTION & ELECTRICAL CONTINUITY

The design and installation shall ensure electrical continuity and the ability of the assembly(s) to withstand all forces due to a lightning strike in accordance with EN 62305-1:2011 'Protection against lightning. General principles' and BS 7671:2008+A3:2015 'Requirements for Electrical Installations. IET Wiring Regulations'. Earthing lugs where required shall be located in accessible but inconspicuous places.

### 3.7 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the metal fabrication installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s).
7. Warranties: Refer to Clause No's 1.13 & 1.15.
8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

### 3.8 WASTE

- A. Remove all loose materials, crating and packing materials from the site of installation.
- B. As specified in Waste Management Plan and as follows. Separate waste products from contaminants. Do not include components of pipe and tube railing materials with wood, plastic, or any glass fibre, vinyl, decorative paper, or other finish. Place in designated area and protect from moisture and contamination.
- C. Identify manufacturer's policy for collection or return of remaining unused material and packaging material. Institute demolition and construction recycling to take advantage of

manufacturer's programs. When such a service is not available, seek local recyclers to reclaim the materials.

**END OF SECTION 05 50 00**

**SECTION 05 51 33 – METAL LADDERS****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

To be read with the Contract, Drawings, BIM Model, other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

A. This section describes the specialist subcontractor structural design, drawings, fabricating, finishing and installation of all fixed ladders, inclined ladders and ladders with cages, structural supports and concealed fixings for the works as described herein and on the Architect's drawings.

The Contractor shall design, test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation. To include all items necessary for full completion and finishing of the work not necessarily included.

**1.3 RELATED WORK****1.4 COMPONENT OR ELEMENT REFERENCES**

LAD-001 – FIXED LADDER WITH CAGE

**1.5 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT

Building Regulations 2010

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

BRITISH STANDARDS INSTITUTION

EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.

EN 485-2:2008 Aluminium and aluminium alloys. Sheet, strip and plate. Mechanical properties.

EN 754-2:2008 Aluminium and aluminium alloys. Cold drawn rod/bar and tube. Mechanical properties.

EN 755-2:2008 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Mechanical properties.

EN 1991-1-1:2002 Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings. + AMD 15507, Corrigendum February 2010

EN 1993-1-4:2006 Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels.

EN 1999-1-1:2007 Eurocode 9: Design of aluminium structures. General structural rules. + AMD March 2010

EN 10025-2:2004 Hot rolled products of structural steels. Technical delivery conditions for non-alloy structural steels.

EN 10088-2:2005 Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.

EN 10088-3:2005 Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.

EN 10210-1:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

EN 10210-2:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties. + AMD 17062

EN 10219-1:2006 Cold formed welded structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

BS 1134:2010 Assessment of surface texture - Guidance and general information.

BS 4211:2005 Specification for permanently fixed ladders. + A1:2008, Corrigendum February 2010, Corrigendum April 2010

BS 4592-0:2006 Industrial type flooring and stair treads. Common design requirements and recommendations for installation.

BS 4592-3:2006 Industrial type flooring and stair treads. Cold formed metal planks. Specification.

BS 4800:1989 Schedule of paint colours for building purposes.

BS 5395-1:2010 Stairs. Code of practice for the design of stairs with straight stairs and winders.

BS 6180:1999 Barriers in and about buildings. Code of practice. + AMD 13292  
 BS 6206:1981 Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings. + AMD 4580, AMD 5189, AMD 7589, AMD 8693  
 BS 6399-1:1996 Loading for buildings. Code of practice for dead and imposed loads. + AMD 13669  
 BS 7976-2:2002 Pendulum testers. Method of operation.  
 BS 8118-2:1991 Structural use of aluminium. Specification for materials, workmanship and protection. + AMD 10486  
 BS 8300:2009 Design of buildings and their approaches to meet the needs of disabled people. Code of practice. + AMD July 2010  
 BS 8493:2008 Light reflectance value (LRV) of a surface. Method of test. + AMD March 2010  
 DD 266:2007 Design of accessible housing. Lifetime home. Code of practice.  
 NA to EN 1991-1-1:2002:2005 UK National Annex to Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings.  
 NA to EN 1993-1-4:2006:2009 UK National Annex to Eurocode 3. Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting.  
 EN 1991-1-1 Eurocode 1: Actions on structures – Part 1-1: General Actions Densities, self-weight, imposed loads for buildings  
 INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)  
 ISO/CD 21542:2008 Building construction. Accessibility and usability of built environment. 2008 WASTE AND RESOURCES ACTION PROGRAMME (WRAP)  
 Guide Choosing construction products: Guide to the recycled content of mainstream construction products.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's product lines of mechanical steel ladders and associated balustrades and handrails.
  2. Ladder support brackets and structural support systems, both concealed and visible.
  3. Grout, anchoring cement, and paint products.
  4. Thermally isolated structural fixings, where railing base will be fixed to the structural slab.
- B. All paints, coatings, adhesives, and sealants wet-applied on site must either meet the technical requirements of the above regulations, or comply with applicable national VOC control regulations, such as the European Decopaint Directive (2004/42/EC).
- C. Shop Drawings:  
 Show the following information on the Shop drawings:
1. Location and configuration of all metalwork.
  2. All sizes and dimensions.
  3. Special fastenings, attachments or anchoring.
  4. Location of products to be galvanized.
  5. Location and support detail of ladders.
- Include plans, elevations, sections, details, and attachments to other work. To include, but not be limited to drawings indicating how the steel ladder base fixings to the concrete walls and floor slab will interface with the waterproofing and insulation and how the thermal continuity and waterproofing will not be compromised by the installation of the steel ladders.
- D. Samples for Initial Selection: For products involving selection of colour, texture, or design, including mechanical finishes on galvanized and stainless steel.
- E. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including treads, risers, handrails, top rails, posts, and balusters. All handrails are to have closed ends, provide samples for approval by the Architects.
  2. Fittings and brackets.
  3. Assembled Sample of ladder system, made from full-size components, including treads, handrails, top rails, posts, and balusters. Sample should include proposed base fitting to include thermally isolated fixings.
    - a. Show method of finishing and/or connecting members at intersections.
- F. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Declarations of Performance (DoPs) are to be provided where required by the CPR.

## 1.7 INFORMATION SUBMITTALS

- A. Product Test Reports: For all manufactured and bespoke ladders, cages and accessories for the project, structural supports and concealed fixings performed by a qualified testing agency.

Based on evaluation of comprehensive tests performed by a qualified testing agency, according to NSAI, INAB, UKAS.

- B. Documentation of manufacturer's take-back programme for damaged products, packaging etc. Include the following:
  - 1. Appropriate contact information.
  - 2. Overview of procedures.
  - 3. Identify manufacturer's policy for collection or return of remaining unused material and packaging material.
  - 4. Indicate manufacturer's commitment to recycle and/or reuse reclaimed materials and packaging.
  - 5. Limitations and conditions, if any, applicable to the project.
- C. Qualification Data: For qualified professional engineer testing agency.
- D. Mill Certificates: Signed by manufacturers of aluminium and steel products certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Copies of structural design calculations/ test reports.
- B. General product information.
- C. Installation information, to include photographs of structural fixings prior to covering up with finishing work.
- D. Inspection and maintenance reports.
- E. Certification of compliance with the Building Regulations for the purposes of compliance with Building Control (Amendment) Regulations 2014 (S.I. 9).

#### 1.9 MAINTENANCE SUBMITTALS

Submit the following for inclusion in the maintenance manual for the building:

- Manufacturer's Instructions
- Cleaning Materials and recommended methods of cleaning.
- Preventative Maintenance and Inspection recommendations.
- Maintenance Instructions.

#### 1.10 QUALITY ASSURANCE

- A. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.  
Fabricator Qualifications: Furnish references listing projects of similar size and scope.
- B. FIELD MEASUREMENTS: Take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of the work. Coordinate fabrication schedule with construction progress to avoid delay of work.
- C. SHOP ASSEMBLY: Preassemble items in the shop to greatest extent possible, so as to minimize field splicing and assembly of units at site.
- D. FABRICATOR'S QUALIFICATIONS: A firm having a minimum of 5 years successful experience in producing metal fabrications similar to that required for this Project. The fabricator shall be subject to approval of the Engineer.
- E. INSTALLER'S QUALIFICATIONS: A firm having a minimum of 5 years successful experience in the installation of metal fabrications similar to that required for this project, and that has been licensed by the Manufacturer of the metal fabrications.
- F. DURABILITY: Selected materials shall be durable and satisfy the requirements of the Specification for the design life of the works.  
The works shall perform throughout its design life without failure resulting from defects in design, materials or workmanship. Failure shall be defined as breakage, disengagement of components, deflection beyond stated values, reduction in performance or unacceptable change in appearance including breakage.  
Accidental Damage/ Robustness: The works shall comply with the Building Regulations and its associated Technical Guidance / Approved / Approved Documents.  
Metal sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.  
Electro-chemical corrosion or staining resulting from water running from one material to another shall be prevented.
- G. WIND LOADING: Design the works to withstand pressures calculated in accordance with BS 6399: Part 2, to prevent loss of weatherproofing and permanent deformation due to wind pressure or suction.  
Refer to the Structural Engineer's documentation for wind loads.

- H. SPECIFIC DEAD LOADS: The works shall be capable of accommodating the following dead loads without any reduction in performance:
- Self-weight of materials and components.
  - Weight of attached or supported services and building maintenance equipment.
- SPECIFIC LIVE LOADS: Gauge the selection of aluminium gauge and substrate construction to accommodate the following live loads without any reduction in performance:
- Loads associated with normal maintenance access traffic and in addition any accidental loads imposed by persons falling against or onto the elements.
  - Increased weight due to water absorption, snow and ice. Snow loads shall be in accordance with EN 1991-1-3:2003+A1:2015 Eurocode 1. Actions on structures. General actions. Snow loads.
  - Loads repeatedly imposed by negative and positive wind pressures.
- There shall be no fracture or permanent deformation of any part, nor any deterioration of the subsequent performance of the work resulting from live loads imposed.

#### 1.11 CERTIFICATES

Provide fabricator certification for ladder and cage assembly stating that the ladder and associated components have been fabricated according to the requirements of BS 4211:2005 + A1: 2008 Specification for Permanently Fixed ladders.

Provide fabricator certification for ships ladder assembly stating that the ships ladder and associated components have been fabricated according to the requirements of BS 4211:2005 + A1: 2008 Specification for Permanently Fixed ladders.

#### 1.12 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

#### 1.13 WARRANTY

- A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of ten years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.
- B. Warranties from the Stair Contractor are required for the design of the system and its components. Warranties or letters of certification, in writing, are also required from principal material suppliers, confirming that their materials are being used in such a manner that the requirements of the Contract Documents are met.

#### 1.14 DECLARATION OF CONFORMANCE

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
- The performance requirements for the project.
- The technical specifications standards described herein.

From July 2014 Structural steelwork and aluminium fell under the CPR and therefore requires DOPs and CE Marking to be affixed to show compliance with EN 1090-1.

#### 1.15 PROJECT CONDITIONS

- A. FIELD MEASUREMENTS: The Contractor shall verify all actual locations of walls and other construction contiguous with metal fabrications by field/site measurements before commencement of fabrication.
- B. Discrepancies should they occur, shall be reported immediately to the Architect and Structural Engineer.

#### 1.16 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed with a maintenance free life in excess of 20 years. Within the period of 'maintenance free life' the assembly shall perform at or above the levels specified elsewhere. In accordance with BS ISO 15686-5:2008 'Buildings and constructed assets. Service life planning. Life cycle costing'.
- B. The term 'Maintenance' shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life,

in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.

- D. COMPONENT PARTS: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Architect must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.
- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.17 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Validation according to the Eco-Management and Audit System (EMAS).
  - 3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. All manufactured and bespoke metal fabrications for the project, structural supports and concealed fixings as designed, supplied and installed by a manufacturer regularly engaged in the design and production of such systems.

SECTION 05 51 33

**PART 2 – PRODUCTS**

LAD-001 – FIXED LADDER WITH CAGE

Proprietary galvanised steel fixed vertical ladder with cage (safety hoops) fixed back to primary structure, and secured for access. The ladder shall have a gated side exit to the arrival area at Upper Level.

Material: Galvanised mild steel.

Location: As indicated on the Drawings.

The works shall conform to BS 5395: Part 3, and EN ISO 14122 Part 1, Part 2, Part 3 and Part 4.

Ladder: Proprietary vertical fixed ladder as indicated on the Drawings, fixed to primary structure and gantry support sections. Ladder shall have hooped protection enclosure from gantry to height above finished floor level as indicated on the Drawings.

Gate: Automatically closing gate shall be provided at the head of the ladder, designed to open easily in an outwards direction. The gate shall have at least a handrail and a knee rail.

Cage: The lowest part of safety cage, e. g. the lowest hoop shall start at a height of between 2200 mm and 3000 mm above the departure area. Below the cage on the chosen access side, the safety cage shall not have elements likely to obstruct the access to the area situated in front of the ladder. At the arrival area the safety cage shall be extended up to the height of the guard-rail of the arrival area.

The clear distances within the hoop of the safety cage shall be between 650 mm and 800 mm.

The distance from the rung to the safety cage shall be between 650 mm and 800 mm

The clearance within the cage at the arrival area, measured along the transverse axis of the ladder rungs between the inside face of the cage shall be between 500 mm and 700 mm.

The distance between two hoops shall not exceed 1500 mm and the distance between two uprights on the cage shall not exceed 300 mm. The hoops shall be placed at right angles to the uprights on the cage.

The safety cage uprights shall be fixed to the inside of the hoop and be equally spaced.

Handrails shall be fitted connecting the ladder stiles to the handrail of the guard-rail. Those handrails shall be fixed to the guard-rail at the arrival area.

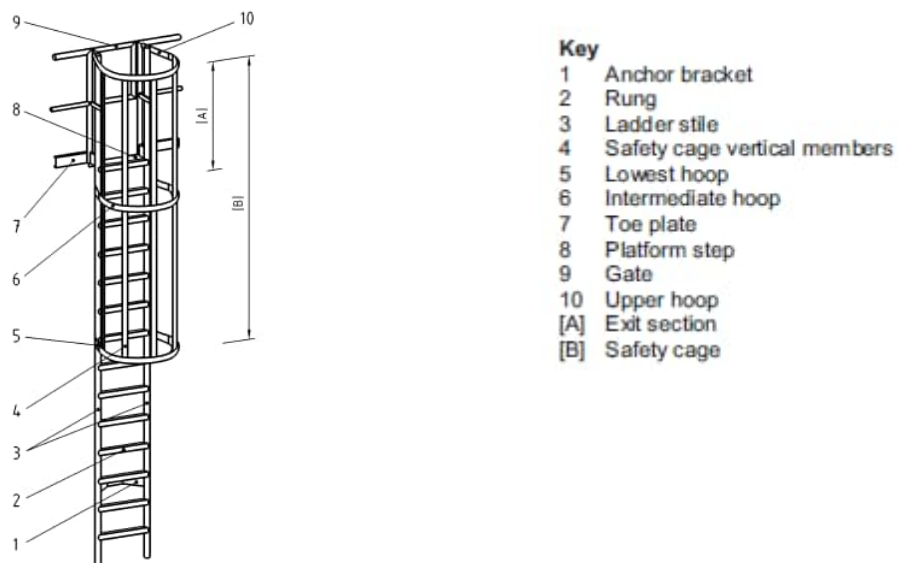
The spacing of safety cage components shall be designed so that the empty spaces are in any case not more than 0.40 m<sup>2</sup>.

Treads shall be flat with anti-slip surface finish. Allow for fixing of service tray's to framework where required.

Fitting and Fixings: In accordance with the manufacturer's instructions and Structural Engineer's approval.

Metalwork finishes: Galvanized to EN ISO 1461 Galvanised mild steel

Accessories: Hazard signage at base and head of ladder.



INDICATIVE IMAGE OF FIXED LADDER WITH CAGE AND GATE

## 2.1 GENERAL

- A. Furnish and install where indicated on plans ladder safety post, yellow powder coat steel. The ladder

### 2.1.1 GALVANIZING

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles.

### 2.1.2 GALVANIZE

Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

### 2.1.3 REPAIR OF ZINC-COATED SURFACES

Repair damaged surfaces with galvanizing repair method and paint conforming to EN ISO 1461:2009 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

### 2.1.4 SHOP CLEANING AND PAINTING

#### 2.1.4.1 SURFACE PREPARATION

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean.

#### 2.1.4.2 PRETREATMENT, PRIMING AND PAINTING

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.03 mm 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.

### 2.1.5 NONFERROUS METAL SURFACES

Protect by plating, anodic, or organic coatings.

### 2.1.6 ALUMINUM SURFACES

#### 2.1.6.1 SURFACE CONDITION

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

#### 2.1.6.2 ALUMINUM FINISHES

Unexposed plate and extrusions may have mill finish as fabricated.

Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminium items with standard mill finish.

Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45.

## 2.2 LADDERS

Fabricate vertical ladders conforming to BS 4211:2005 + A1: 2008 Specification for Permanently Fixed Ladders.

Rungs shall be of a section capable of supporting a mass of 150kg spread over 100mm at the centre of the rung such that the deflection is limited to two millimetres.

Rungs must not be less than 400 mm wide, spaced one foot apart, plug welded or shouldered and headed into stringers. Install ladders so that the distance from the rungs to the finished wall surface will not be less than 175 mm.

Provide heavy clip angles riveted or bolted to the stringer and drilled for not less than two 12 mm diameter expansion bolts as indicated. Provide intermediate clip angles not over 1200 mm on centres. The top rung of the ladder must be level with the top of the access level, parapet or

landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 1100mm above the access level. Provide ladder access protective swing gates at the top of access/egress level. The drawings must indicate ladder locations and details of critical dimensions and materials.

### 2.2.1 LADDER CAGES

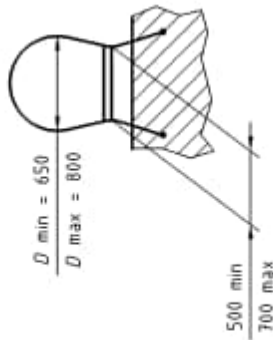
The lowest part of safety cage, e. g. the lowest hoop shall start at a height of between 2200 mm and 3000 mm above the departure area. Below the cage on the chosen access side, the safety cage shall not have elements likely to obstruct the access to the area situated in front of the ladder. At the arrival area the safety cage shall be extended up to the height of the guard-rail of the arrival area.

The clear distances within the hoop of the safety cage shall be between 650 mm and 800 mm. This applies equally to non-circular as well as circular safety cages. The distance from the rung to the safety cage shall be between 650 mm and 800 mm. With regard to the ladder axis, the distance from the surrounding structure in the absence of a safety cage shall be between 325 mm and 400 mm.

The clearance within the cage at the arrival area, measured along the transverse axis of the ladder rungs between the inside face of the cage shall be between 500 mm and 700 mm.

The distance between two hoops shall not exceed 1500 mm and the distance between two uprights on the cage shall not exceed 300 mm. The hoops shall be placed at right angles to the uprights on the cage. The safety cage uprights shall be fixed to the inside of the hoop and be equally spaced.

The spacing of safety cage components shall be designed so that the empty spaces are in any case not more than 0.40 m<sup>2</sup>.



PLAN VIEW OF A LADDER WITH A SAFETY CAGE

### 2.2.2 LADDER SAFETY DEVICES

Conform to 29 CFR 1910.27 and Section 7 of ALI A14.3. Install ladder safety devices on ladders over 6000 mm long or more. The ladder safety systems must meet the design requirement of the ladders which they serve. The ladder safety system must be capable of sustaining a static load of 1,000 pounds.

### 2.2.3 SHIP'S LADDER

Fabricate stringers and framing of steel plate or shapes. Bolt, rivet or weld connections and anchor to supporting construction. Provide treads with non-slip surface as specified for safety treads.

Aluminium ladders may be provided, subject to approval of treads, materials, and shop drawings. Requirements shown or specified for steel apply. Provide anchor items of zinc-coated steel.] Design assembly, including tread connections and methods of attachment, to support a live load of 1300 N per tread. Provide railings as specified for metal handrails.

## SECTION 05 51 33

**PART 3 – EXECUTION****3.0 GENERAL INSTALLATION REQUIREMENTS**

- A. Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide Exposed fastenings of compatible materials, generally matching in colour and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

**3.1 LIGHTNING PROTECTION & ELECTRICAL CONTINUITY**

The design and installation shall ensure electrical continuity and the ability of the assembly(s) to withstand all forces due to a lightning strike in accordance with EN 62305-1:2011. 'Protection against lightning. General principles' and BS 7671:2008+A3:2015 'Requirements for Electrical Installations. IET Wiring Regulations'. Earthing lugs where required shall be located in accessible but inconspicuous places.

**3.2 WORKMANSHIP**

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact.

Do not tack weld exposed connections of work in place. Grid smooth exposed welds. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or mitre corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

**3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS**

Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material.

Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in colour and finish, to which fastenings are applied. Conceal fastenings where practicable.

**3.4 WELDING**

Perform welding, welding inspection, and corrective welding, in accordance with Welding, Allied processes and Non-destructive testing and / or AWS D1.1/D1.1M. Use continuous welds on all exposed connections.

Grind visible welds smooth in the finished installation.

**3.5 FINISHES****3.5.1 DISSIMILAR MATERIALS**

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminium is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

**3.5.2 FIELD PREPARATION**

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

**3.5.3 ENVIRONMENTAL CONDITIONS**

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 15 degrees C 5 degrees F above the dew point of the

surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

### 3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 12 mm diameter expansion bolts. Install intermediate clip angles not over 1200 mm on centre. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. Ends of ladders must not rest upon finished roof / floor.

### 3.7 PROTECTION

- A. Protect all ladders, handrails and finishes from damage during construction period with temporary protective coverings approved by the ladder manufacturer. Remove protective coverings at time of Practical Completion.

### 3.8 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the metal fabrication installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s).
7. Warranties: Refer to Clause No 1.13.
8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

### 3.9 WASTE

- A. Remove all loose materials, crating and packing materials from the site of installation.
- B. Waste Management:  
Coordinate with manufacturer for take-back programme. Set aside packaging and scrap, including damaged units to be returned to manufacturer for recycling and or reuse.

**END OF SECTION 05 51 33**

**SECTION 07 42 00 – WALL CLADDING PANELS****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. To be read with the Contract, Drawings, BIM Manual, other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

- A. This section describes the specialist sub-contractor structural design, drawings, fabricating, finishing, installation, commissioning and warranting of external insulated metal wall panels and canopies with insulation, vapour control, waterproofing, profiled metal sheeting, structural supports and concealed fixings, and internal composite insulated metal wall panels for the works as described herein and on the Architect's drawings. Test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation. To include all items necessary for full completion and finishing of the work not necessarily included and the procedures prescribed in the CWCT Standard for Systemised Building Envelopes.

**1.3 DEFINITIONS**

Metal Wall Panel Assembly: Insulated-core metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

**1.3.1. COMPONENTS:**

EWP-001 – METAL COMPOSITE CLADDING PANEL FOR EXTERNAL FACADE WALL – TYPE 1.

EWP-002 – METAL COMPOSITE CLADDING PANEL FOR EXTERNAL FACADE WALL – TYPE 2.

EWP-003 – RAINSCREEN CLADDING HK-DESIGN CASSETTES – TYPE 03

**EWP-004 – METAL COMPOSITE CLADDING PANEL FOR GREEN WALL SUBSTRATE**

ALU-001 – ALUMINIUM PROFILE PANEL – CANOPY SOFFIT.

FIN-001 – EXTRUDED ALUMINIUM SOLAR SHADING SYSTEM.

**1.4 PERFORMANCE REQUIREMENTS**

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Comply with the general performance of Division 01 and the following specific performance requirements.

**1.4.1 SPECIFIC MOVEMENTS**

The works shall withstand all movement of the structure under all design loads or combination of loads without damage or reduction in performance.

Expansion and movement joints shall accommodate the appropriate range of movement.

Refer to, and take account of the Structural Engineer's Movements and Tolerances information as defined within the SE's Documentation.

**1.4.2 SPECIFIC LIVE LOADS**

The works shall be capable of accommodating the following specific live loads without any reduction in performance:

Horizontally applied loads acting on the surface of any component. The works shall sustain safely, without reduction in performance and without permanent deformation to any component, a static 500N load applied horizontally through a square of 100mm sides on any part of the framing.

A horizontal line load applied to the works, due to the occupants, in accordance with BS 6180 and EN 1991-1-1:2002 Eurocode 1. Actions on structures. General actions. Densities, self-weight, imposed loads for buildings

**1.4.3 WIND LOADS**

Wind loading shall be accommodated safely, without detriment to the overall design, structural integrity and performance of the works.

Design Wind Pressures: Refer to the Structural Engineer.

Calculated pressure loads shall include the effect of internal air pressures within the building, taking into account the presence of significant openings, which might arise occasionally within the building enclosure.

#### 1.4.4 THERMAL MOVEMENT

All components shall resist thermal movement resulting from the maximum and minimum surface temperature differentials occurring. The design shall cater for all temporary and permanent conditions envisaged for the works.

The works shall be capable of accommodating changes in dimension and shape of its components resulting from the varying surface temperatures without any reduction in the specified performance.

Thermal movements shall not result in audible noise.

#### 1.4.5 MOISTURE MOVEMENT

The works shall withstand movement without permanent deformation or any reduction in the specified performance:

Due to changes in the moisture content of its components, resulting from variations in the moisture content of the air.

Due to the expansion of absorbed or retained moisture caused by freezing.

Caused by the flow of rainwater to the inside of the panels.

#### 1.4.6 THERMAL PERFORMANCE REQUIREMENTS

Comply with the requirements of Technical Guidance / Approved / Approved Document Part L of the Building Regulations. Provide U-value calculations including condensation calculations to justify insulation and vapour barrier design.

#### 1.4.7 SOLAR PERFORMANCE REQUIREMENTS

Exposure to sunlight during the service life of the works shall not result in degradation of appearance or performance.

#### 1.4.8 AIR PERMEABILITY/ INFILTRATION

The works shall resist the passage of air such that its air leakage rates, if measured in accordance with EN 12153 shall not be exceeded in both the initial and repeat tests.

Air leakage through the works and at interface conditions shall accord with the requirements of Technical Guidance / Approved / Approved Document Part L of the Building Regulations.

#### 1.4.9 CONDENSATION

No condensation shall take place either on internal or external surfaces, or within the interstitial construction thickness of the works under the temperature and humidity conditions listed in clause.

#### 1.4.10 CAPILLARITY

Gaskets and seals shall be designed to incorporate capillarity breaks to prevent the ingress and entrapment of water between surfaces in continuous contact.

#### 1.4.11 WEATHER AND WATER PENETRATION RESISTANCE

The works, including flashings and junctions with adjacent components, shall be fully weatherproof and watertight under all conditions with full allowance made for deflections and other movements.

#### 1.4.12 ACOUSTIC: SOUND INSULATION

The works shall provide the sound insulation levels specified, which shall be achieved on site for each type, inclusive of all services penetrations and interfaces with other elements.

The Weighted Sound Reduction Index (R<sub>w</sub>) and the Apparent Weighted Sound Reduction Index (R'<sub>w</sub>) shall be defined according to EN ISO 717.

Refer to the Acoustic Consultant's Report.

#### 1.4.13 DURABILITY

The performance criteria shall be satisfied for the full design life of the works, as stated by the Specification, provided always that the maintenance has been carried out as specified.

Metal sheets shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.

#### 1.4.14 IMPACT AND ABRASION RESISTANCE

Generally, surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects without any noticeable change to the surface appearance. The works shall resist abrasion from cleaning methods and maintenance systems without any noticeable change in surface appearance. Impact tests shall be carried out on all works assemblies adjacent to pedestrian areas in accordance with the recommendations of BS 8200. Tests shall conform to category B requirements.

The extent of any damage determined through testing shall be recorded and, where possible, quantified. Samples shall be submitted to the Architect.

Details of tests shall be provided to demonstrate the performance of materials and finishes in resisting abrasion from pedestrian traffic (hands, rings, luggage, cloth, shoes, etc.) and any other abrasion resulting from adjacent traffic movements.

#### 1.4.15 DEMOUNTABILITY

Elements of the works shall be individually and independently removable ensuring access for maintenance and/ or replacement of panels in the event of damage.

The removal of panels shall not affect the performance or safety of adjacent or any other part of the works.

#### 1.4.16 SPECIFIC FIRE PERFORMANCE REQUIREMENTS

Elements of the works shall be either non-combustible or not easily ignitable with low flame spread characteristics and shall not produce excessive quantities of smoke or toxic gases.

Surface spread of flame:

External areas shall meet unprotected limitations under requirement "External Fire Spread" in Technical Guidance / Approved / Approved Document Part B of the Building Regulations.

All materials used internally and externally shall have a Class 0 surface spread of flame classification (unless otherwise specified) when tested in accordance with BS 476: Parts 6 and 7.

#### 1.4.17 FIRE AND SMOKE STOPPING

Provide all cavity barriers to meet the requirements of the Technical Guidance / Approved / Approved Document Part B of the Building Regulations.

Fire and smoke stops shall be positively fixed in position in such a manner that they will not become dislodged in the event of a fire.

#### 1.4.18 PRIMARY COMPONENTS

The following components shall be primary components:

- Panels.
- Support brackets.

#### 1.4.19 SECONDARY COMPONENTS

The following components shall be considered secondary components:

- Fixings.
- Gaskets.
- Secondary components shall be capable of replacement without progressive dismantling of the works.

#### 1.5 REFERENCES:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT  
Building Regulations 2010

AIR TIGHTNESS TESTING AND MEASUREMENT ASSOCIATION (ATTMA)  
L2 Technical Standard L2. Measuring air permeability of building envelopes (non-dwellings).  
October 2010 issue. 2010

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

BRITISH STANDARDS INSTITUTION

EN ISO 717-1:2013 Acoustics - Rating of sound insulation in buildings and of building elements.  
Airborne sound insulation.

EN ISO 6946:2007 Building components and building elements. Thermal resistance and thermal transmittance. Calculation method.

EN ISO 7010:2012 Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010:2011). +A5:2015

EN ISO 10140-1:2010 Acoustics - Laboratory measurement of sound insulation of building elements. Application rules for specific products. + A2:2014

EN ISO 10140-3:2010 Acoustics - Laboratory measurement of sound insulation of building elements. Measurement of impact sound insulation. + A1:2015

EN ISO 10140-4:2010 Acoustics. Laboratory measurement of sound insulation of building elements. Measurement procedures and requirements.

EN ISO 10140-5:2010 Acoustics - Laboratory measurement of sound insulation of building elements. Requirements for test facilities and equipment. + A1:2014

EN ISO 10211:2007 Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations.

EN ISO 13788:2012 Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods (ISO 13788:2012).

EN ISO 14021:2001 Environmental labels and declarations - Self-declared environmental claims (Type II environmental labelling). + A1:2011 (Renumbered from BS ISO 14021:1999)

EN 485-2:2013 Aluminium and aluminium alloys - Sheet, strip and plate. Mechanical properties.

EN 508-1:2014 Roofing and cladding products from metal sheet - Specification for self-supporting of steel, aluminium or stainless steel sheet. Steel.

EN 508-2:2008 Roofing products from metal sheet. Specification for self-supporting products of steel, aluminium or stainless steel sheet. Aluminium. + Corrigendum 1

EN 508-3:2008 Roofing products from metal sheet. Specification for self-supporting products of steel, aluminium or stainless steel sheet. Stainless steel.

EN 573-3:2013 Aluminium and aluminium alloys - chemical composition and form of wrought products. Chemical composition and form of products.

EN 1013:2012 Light transmitting single skin profiled plastic sheets for internal and external roofs, walls and ceilings - Requirements and test methods. +A1:2014

EN 1090-2:2008 Execution of steel structures and aluminium structures. Technical requirements for steel structures. +A1:2011

EN 1991-1-3:2003 Eurocode 1. Actions on structures. General actions. Snow loads. + AMD 15509, Corrigendum March 2009

EN 10088-1:2014 Stainless steels. List of stainless steels.

EN 10088-2:2014 Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.

EN 10088-3:2014 Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.

EN 10147:2000 Continuously hot-dip zinc coated structural steels strip and sheet. Technical delivery conditions.

EN 10214:1995 Continuously hot-dip zinc-aluminium (ZA) coated steel strip and sheet. Technical delivery conditions.

EN 10215:1995 Continuously hot-dip zinc aluminium (AZ) coated steel strip and sheet. Technical delivery conditions.

EN 10346:2009 Continuously hot-dip coated steel flat products. Technical delivery conditions.

EN 13162:2012 Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification.

EN 13859-1:2014 Flexible sheets for waterproofing - Definitions and characteristics of underlays. Underlays of discontinuous roofing.

EN 13859-2:2014 Flexible sheets for waterproofing - Definitions and characteristics of underlays. Underlays for walls.

BS 476-3:2004 Fire tests on building materials and structures. Classification and method of test for external fire exposure to roofs. + AMD 16169, AMD 16924

BS 476-7:1997 Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products. Incorporating corrigendum No. 1

BS 1449-2:1983 Steel plate, sheet and strip. Specification for stainless and heat-resisting steel plate, sheet and strip. + AMD 4807, AMD 6646, AMD 8828, AMD 9648

BS 3083:1988 Specification for hot-dip zinc coated and hot-dip aluminium/zinc coated corrugated steel sheets for general purposes. + AMD 6054, AMD 8761

BS 4800:2011 Schedule of paint colours for building purposes.

BS 5250:2011 Code of practice for control of condensation in buildings.

BS 5821-3:1984 Methods for rating the sound insulation in buildings and of building elements. Method for rating the airborne sound insulation of facade elements and facades.

BS 5950-2:2001 Structural use of steelwork in building. Specification for materials, fabrication and erection. Rolled and welded sections.

BS 5950-7:1992 Structural use of steelwork in building. Specification for materials and workmanship: cold formed sections.

NA to EN 1991-1-3:2003:2005 UK National Annex to Eurocode 1. Actions on structures. General actions. Snow loads. + AMD 17170

EUROPEAN COMMISSION

Regulation (EC) 305/2011/EU Laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC. 2011

METAL CLADDING AND ROOFING MANUFACTURERS ASSOCIATION  
Manufacturing tolerances for profiled metal roof and wall cladding. 2006

Technical Bulletin 14 Update to MCRMA/EPIC technical paper No 17. 2007

Technical Paper 1 Recommended good practice for daylighting in metal clad buildings. 2nd edition. 2004

Technical Paper 2 Curved sheeting manual. 1991

Technical Paper 3 Secret fix roofing design guide. Revised edition. 1999

Technical Paper 5 Metal wall systems design guide. 2nd edition. 2004

Technical Paper 6 Profiled metal roofing design guide. 2nd edition. 2004

Technical Paper 7 Fire design of steel sheet clad external walls for building - construction performance standards and design. 1994

Technical Paper 8 Acoustic design guide for metal roof and wall cladding systems. 1994

Technical Paper 11 Metal fabrications: Design, detailing and installation guide. 2006

Technical Paper 12 Fasteners for metal roof and wall cladding - Design, detailing and installation guide. 2000

Technical Paper 14 Guidance for the design of metal roofing and cladding to comply with Approved Document L2:2001. 2002

Technical Paper 16 Guidance for the effective sealing of end lap details in metal roofing constructions. 2004

Technical Paper 17 Design guide for metal roofing and cladding to comply with energy requirements of UK Building Regulations (2006). 2007

Technical Paper 18 Conventions for calculating U-values, f-values and Psi-values for metal cladding systems using two and three dimensional thermal calculations. 2006

Technical Paper 20 Appropriate selection of metal thickness for use in walling and roofing applications. 2010

TATA STEEL  
Trisobuild Systems. External site assembled roof and wall systems. 2011

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)  
Guide Choosing construction products: Guide to the recycled content of mainstream construction products. Version 4. 2008

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.  
Before procuring Insulated Metal Panels and supporting steel the General Contractor shall submit one of the following for MCA Architects approval:
1. An Environmental Product Declaration (EPD) that conforms to ISO14025, and EN15804 or ISO21930.
  2. A1-A3 Life Cycle Assessment calculations that conform to ISO14044, and EN15804 or ISO21930.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work.
1. Accessories: Include details of the following items, at a scale of not less than 1:10:
    - Flashing and trim.
    - Anchorage systems.
- C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied colour finishes.
1. Include similar Samples of trim and accessories involving colour selection.
  2. Include manufacturer's colour charts consisting of strips of cured sealants showing the full range of colours available for each sealant exposed to view.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Wall Panels: 305 mm long by actual panel width. Include fasteners, battens, closures, and other metal wall panel accessories.
  2. Trim and Closures: 305 mm long. Include fasteners and other exposed accessories.
  3. Accessories: 305 mm long Samples for each type of accessory.
- E. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.7 INFORMATION SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items. Show the following:
  - 1. Wall panels and attachments.
  - 2. Stud framing.
  - 3. Wall-mounted items including doors, windows, louvres, and lighting fixtures.
  - 4. Penetrations of wall by pipes and utilities.
- B. Qualification Data: For Installer, professional engineer and testing agency.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- D. Field quality-control reports.
- E. Warranties: Sample of special warranties.

### 1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For insulated-core metal wall panels to include in maintenance manuals.

### 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to NSAI, INAB, UKAS for testing indicated.
- C. Source Limitations: Obtain each type of metal wall panel from single source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per BS 9999.
  - 2. Intermediate-Scale Multi-storey Fire Test: Tested mock-up, representative of completed multistore wall assembly of which wall panel is a part, complies with BS 9999 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
  - 3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
  - 4. Potential Heat: Acceptable level when tested according to NFPA 259.
  - 5. Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per BS 9999.
- E. PROTOTYPE REQUIREMENTS:  
A prototype shall be provided as follows:  
A prototype comprising of not less than 5 m<sup>2</sup>, including method of fixing and jointing.  
BENCHMARK REQUIREMENTS:  
The following quality benchmarks shall be provided:  
The first structural bay of each type composite panel cladding in location to be agreed with the Architect.  
MOCK-UPS: Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mock-up of typical wall and corner panel assembly as shown on Drawings; one bay wide by one story high by full thickness, including insulation, supports, attachments, and accessories.
  - 2. Conduct water spray test of mock-up of metal wall panel assembly, testing for water penetration according to Technical Notes from CWCT.
  - 3. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.
  - 4. Approved mock-ups may become part of the completed Work if undisturbed at time of Practical Completion.
- F. PREINSTALLATION CONFERENCE: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvres.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.

#### 1.10 ENGINEER OF RECORD

The Engineer of Record must be currently registered within the jurisdiction of the project.

The Engineer of Record must be approved, authorized, and currently registered with the Institution of Engineers of Ireland (IEI), and have a minimum of five years' experience as registered Engineer.

The Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. The Engineer of Record must provide certified engineering calculations for:

The works described herein and on the drawings and associated requirements in accordance with British Standard and European codes.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

#### 1.12 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

#### 1.13 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leak-proof, secure, and noncorrosive installation.

#### 1.14 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures, including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  2. Warranty Period: 25 years from date of Practical Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Colour fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Practical Completion.

**1.15 DECLARATION OF CONFORMANCE**

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE marking if they are to be placed on the market.

The performance requirements for the project.

The technical specifications standards described herein.

From July 2014 Structural steelwork and aluminium fell under the CPR and therefore requires DOPs and CE marking to be affixed to show compliance with EN 1090-1.

**1.16 SINGLE SOURCE WARRANTY**

All components and “build-up of components” shall be covered by a single source, insurance backed warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified.

All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions.

Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Architect.

**1.17 INDICATIVE MANUFACTURERS**

A. The Manufacturer should be registered to ISO 9001 and have or provide the following:

1. ISO 14001 Environmental Management Systems certification.
2. Validation according to the Eco-Management and Audit System (EMAS).
3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.

B. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work to include but not to be limited to, the following:

Paroc Panel Systems., The Coach House, 63 Victoria Road, Chester, Cheshire, CW2 2AX.  
Tel: +44 (0) 7469 080181. Email: panelsinfo.irl@parocpanels.com

Kingspan Insulation Ltd., Bree Industrial Estate, Castleblayney, Co. Monaghan  
Tel: +353 (0)42 979 5000. Email: info@kingspaninsulation.ie

Eurobond Ltd., Wentloog Corporate Park, Wentloog Road, Cardiff CF3 2ER, UK  
Tel: +44 (0)29 20 776677. Email: sales@eurobond.co.uk. www.eurobond.co.uk

Architectural & Metal Systems, Wallingstown, Little Island, Cork T45 VP40  
Tel: +353 (0)21 4705100. Fax: +353 (0)21 4705199. Email: info@ams.ie

## SECTION 07 42 00

**PART 2 – PRODUCTS**EWP-001 – METAL COMPOSITE CLADDING PANEL FOR EXTERNAL WALL – TYPE 01

Insulated flat panel metal faced composite panel wall cladding system  
Product reference: Paroc AST-L Wall Panel. FM Approved : FM 4880.

**CONSTRUCTION:**

- Core insulation: AST® stone wool, fibres uniformly aligned to achieve controlled strength properties.
- Core thickness: 240mm.
- Facing material: Hot dip galvanized coil-coated steel sheet.  
External sheet thickness 0.6mm.  
Internal sheet thickness 0.5mm thick.
- Factory applied weather seal.
- Module cover width: 1200mm.
- Panel lengths: Single panel lengths required to span as per elevations. 2m to 12m.
- Weight: 27 kg/m<sup>2</sup> (dead load).
- External profilation: Smooth flat finish with Shadow panel joint.
- External Coating: PVDF Spectrum RC5 50 Micrometres.
- Exteranal Colour – Refer to design drawings for RAL colour references.
- Innernal profilation: Smooth flat finish.
- Internal Coating: PE Polyester 25 Micrometres.
- Internal Colour: R106 Pure White.

**PERFORMANCE:**

- Reaction to fire: A2-s1,d0 to EN 13501-1.
- Single figure weighted sound reduction  $R_w = 24$ dB.
- U-Value: 0.15 W/m<sup>2</sup>K.
- System air leakage: <3m<sup>3</sup>/hr/m<sup>2</sup> at 50Pa.
- Panels to have no cavities, gaps, cold bridges or interstitial condensation risk.
- Tolerances: Length: +8 mm, -8 mm. Width: +3 mm, -3 mm. Thickness: +3 mm, -3 mm. End squareness: +0.5 mm, -0.5 mm.
- Structural performance: Refer to manufacturer's data sheets.
- Guaranteed long term performance: Up to 25 years to first maintenance and overall life expectancy of up to 40 years.

**ASSEMBLY:**

- Refer to assembly drawings and manufacturer's site assembly instructions.
- Secondary support steelwork shall be designed in accordance with the requirements of the relevant parts of EN 1993-1-1:2005+A1:2014 Eurocode 3. "Design of steel structures. General rules and rules for buildings" where applicable, unless stated otherwise, and fixed as shown on the Drawings. Wind loads to be calculated in accordance with BS 6399-2, Standard Method and BS 5427-1 appropriate to location, exposure, height, building shape and size, taking account of existing and known future adjacent structures.  
Secondary steelwork construction must be calculated and executed in accordance with DIN 18 800. The corrosion protection of steel structures must be in accordance with DIN 55 928. The steel profiles must be prepared for paint to be applied by others. The contractor for the painting work must be advised that the profile surfaces must be cleaned and primed before being painted.  
Finish and corrosion protect supports/ cladding rails: Galvanised and/ or primed and painted in accordance with the Specification in particular Section 09 91 23 (Painting) and other relevant parts of the Specification.
- Panels to be designed to span between supports as required. Provide all support to the assemblies including all cladding fixings, having due regard for any requirements shown on the Design Drawings and in excess of primary structure shown on the Structural Engineer's Drawings.
- Concealed gaskets, secret fixed back to cladding rails including all supports and framing as required. Insulated composite panels to comprise aluminium sheet outer face and press folded galvanised mild steel or aluminium inner sheet forming a continuous vapour barrier.
- Joints in cladding shall be male and female interlocking joints on all 4 sides of panels with nominal 8-10mm panel edge black gasket extrusions (neoprene or uPVC or acceptable equivalent) for horizontal and vertical joints (i.e. horizontal and vertical joints to be of equal size).

EWP-002 – METAL COMPOSITE CLADDING PANEL FOR EXTERNAL WALL– TYPE 02

Insulated flat panel metal faced composite panel wall cladding system.  
Product reference: Paroc AST-L Wall Panel. FM Approved : FM 4880.

**CONSTRUCTION:**

- Core insulation: AST® stone wool, fibres uniformly aligned to achieve controlled strength properties.
- Core thickness: 240mm.
- Facing material: Coated steel to AS1397.  
External sheet thickness 0.6mm.  
Internal sheet coated steel to AS1397, 0.5mm thick.
- Factory applied weather seal.
- Module cover width: 1200mm.
- Panel lengths: Single panel lengths required to span as per elevations.
- Weight: 27 kg/m<sup>2</sup> (dead load).
- External profilation: Micro Rib with Shadow panel joint.
- External Coating: PVDF Spectrum RC5 50 Micrometres.
- External Colour – Refer to design drawings for RAL colour references.
- Internal profilation: Smooth flat finish.
- Internal Coating: PE Polyester 25 Micrometres.
- Internal Colour: R106 Pure White.

**PERFORMANCE:**

- Reaction to fire: A2-s1,d0 to EN 13501-1.
- Single figure weighted sound reduction  $R_w = 24$ dB.
- U-Value: 0.15 W/m<sup>2</sup>K.
- System air leakage: <3m<sup>3</sup>/hr/m<sup>2</sup> at 50Pa.
- Panels to have no cavities, gaps, cold bridges or interstitial condensation risk.
- Tolerances: Length: +8 mm, -8 mm. Width: +3 mm, -3 mm. Thickness: +3 mm, -3 mm. End squareness: +0.5 mm, -0.5 mm.
- Structural performance: Refer to manufacturer's data sheets.
- Guaranteed long term performance: Up to 25 years to first maintenance and overall life expectancy of up to 40 years.

**ASSEMBLY:**

- Refer to assembly drawings and manufacturer's site assembly instructions.
- Secondary support steelwork shall be designed in accordance with the requirements of the relevant parts of EN 1993-1-1:2005+A1:2014 Eurocode 3. "Design of steel structures. General rules and rules for buildings" where applicable, unless stated otherwise, and fixed as shown on the Drawings. Wind loads to be calculated in accordance with BS 6399-2, Standard Method and BS 5427-1 appropriate to location, exposure, height, building shape and size, taking account of existing and known future adjacent structures.  
Secondary steelwork construction must be calculated and executed in accordance with DIN 18 800. The corrosion protection of steel structures must be in accordance with DIN 55 928. The steel profiles must be prepared for paint to be applied by others. The contractor for the painting work must be advised that the profile surfaces must be cleaned and primed before being painted.  
Finish and corrosion protect supports/ cladding rails: Galvanised and/ or primed and painted in accordance with the Specification in particular Section 09 91 23 (Painting) and other relevant parts of the Specification.
- Panels to be designed to span between supports as required. Provide all support to the assemblies including all cladding fixings, having due regard for any requirements shown on the Design Drawings and in excess of primary structure shown on the Structural Engineer's Drawings.
- Concealed gaskets, secret fixed back to cladding rails including all supports and framing as required. Insulated composite panels to comprise aluminium sheet outer face and press folded galvanised mild steel or aluminium inner sheet forming a continuous vapour barrier.
- Joints in cladding shall be male and female interlocking joints on all 4 sides of panels with nominal 8-10mm panel edge black gasket extrusions (neoprene or uPVC or acceptable equivalent) for horizontal and vertical joints (i.e. horizontal and vertical joints to be of equal size).

EWP-003 – RAINSCREEN CLADDING HK-DESIGN CASSETTES – TYPE 03

Aluminium cassette panels HK-Design Cassettes

#### 1.0 Contact details

Address: Kingspan Limited, Carrickmacross Road, Corgarry, Kingscourt, Co. Cavan, A82 E897.

Telephone: + 353 42 9698500

Web: [www.kingspanpanels.ie](http://www.kingspanpanels.ie)

Email: [technical.ireland@kingspan.com](mailto:technical.ireland@kingspan.com)

2.0 Primary support structure: K-Roc Karrier (240mm thick).

#### 3.0 Rainscreen cladding system

3.1 Manufacturer: Kingspan Insulated Panels

3.2 Product reference: HK Design Cassette - Aluminium (Polyester Powder-coated)

3.3 Standard:

- ISO 9001, Quality Management Systems.
- ISO 14001, Environmental Management Systems.
- ISO 45001, Occupational Health and Safety Management Systems.
- ISO 50001, Energy Management Certificate
- ISO 37301, Compliance Management Systems

3.4 Alloy:

3.4.1 Grade: To BS EN 573-3, grade EN AW-3103.

3.4.2 Temper: To BS EN 515, H14.

3.4.3 Sheet thickness: 3 mm.

3.5 Panel size:

HK-Design cassettes can be installed in either a landscape or portrait orientation.

Large cassettes can be fabricated due to the structural design of this cassette system.

Cassette Sizes:

Minimum 300 x 130 mm (landscape).

Maximum 1350 x 3800 mm (portrait or landscape).

Face width to be determined from wind loads obtained from Attachment clause.

Cassette Depth: 60mm

3.6 Stiffeners: Factory applied stiffeners attached via studs welded to the rear of the cassette face as determined by project specific wind load calculations and design.

3.7 Finish;

3.7.1 Material: Polyester Powder Coated

3.7.2 Thickness: 60 µm.

3.8 Colour:

Polyester powder coating from Kingspan Facades Colours & Coatings range or available in standard RAL match colours. Refer to design drawings for RAL colour.

3.9 Fasteners:

Number and location: As determined by attachment clause. Cassettes are secured to vertical mullions by means of an arrangement of slots engaged with proprietary metal clips.

3.10 Joint type: Vertical and horizontal baffled joints.

3.10.1 Joint width: 18mm

3.11 Reaction to fire

3.11.1 Panel external face: To EN 13501-1, Class A2-s1, d0.

4.0 Air Gap: Minimum 40mm

5.0 Secondary support/ framing system: Vertical aluminium mullion with locating clip and EPDM isolator.

5.1 Manufacturer: Kingspan Limited, Carrickmacross Road, Corgarry, Kingscourt, Co. Cavan, A82 E897

Tel: + 353 42 9698500. Email: [technical.ireland@kingspan.com](mailto:technical.ireland@kingspan.com) Web: [www.kingspanpanels.ie](http://www.kingspanpanels.ie)

- 5.1.1 Product reference: Mullion Ref: KSHOM with locating clip Ref: KSHOLC, EPDM isolator Ref: KSHOIC62 and clip fastener Ref: KSM8X15HS-M. Mullion sealed to panel with two runs of PVC sealant tape KSSVG25.
- 5.2 Material: Aluminium. Mullion polyester powder coated - Black.
- 5.3 Number and Location: To suit cassette dimensions and wind loads determined from attachment clause.
- 5.4 Fasteners: Stainless steel fasteners Ref: KSAFL6
- 5.4.1 Number and location: To suit cassette dimensions and wind loads determined from attachment clause.
- 5.5 Other components: End mullion Ref: KSHOEM, End locating clip Ref: KSHOELC and EPDM End isolator Ref: KSHOIC30.
- 6.0 Cavity Barriers: TENMAT VFB Plus 30 x 75mm wide Intumescent Fire Barrier fixed to face of Wall Liner Panel at 250mm maximum.
- 7.0 Backing wall: K-Roc Karrier
- 8.0 PURPOSE MADE COLD FORMED METAL ACCESSORIES – EXTERNAL FOR FACADE:
- 8.1 Manufacturer: Kingspan Limited, Carrickmacross Road, Corgarry, Kingscourt, Co. Cavan, A82 E897 Tel: + 353 42 9698500. Email: [technical.ireland@kingspan.com](mailto:technical.ireland@kingspan.com) Web: [www.kingspanpanels.ie](http://www.kingspanpanels.ie)
- 8.2 Material/finish : Same material and finish as facade
- 8.3 Thickness: Same as facade
- 8.4 Colour: To match facade
- 8.5 Workmanship: as section Z11.
- 8.6 Fixing:  
Stitch to external face of panels at 450 mm centres using low profile colour head stainless steel stitcher screws.  
End laps formed by butt straps. Only one flashing end to be stitched to butt strap and a 3mm gap should be left between flashing ends.
- 8.7 Sealing:  
Single line of 9 x 3mm butyl sealant, Class A, ref: NFRC TB36, site applied between flashing and panel.  
End laps air sealed with Single line of 9 x 3mm butyl sealant, Class A, ref: NFRC TB36 or non-curing gun grade sealant.

**PERFORMANCE:**

- Reaction to fire: A2-s1,d0 to EN 13501-1.
- Single figure weighted sound reduction  $R_w = 24\text{dB}$ .
- U-Value:  $0.15\text{ W/m}^2\text{K}$ .
- System air leakage:  $<3\text{m}^3/\text{hr}/\text{m}^2$  at 50Pa.
- Panels to have no cavities, gaps, cold bridges or interstitial condensation risk.
- Tolerances: Length: +8 mm, -8 mm. Width: +3 mm, -3 mm. Thickness: +3 mm, -3 mm. End squareness: +0.5 mm, -0.5 mm.
- Structural performance: Refer to manufacturer's data sheets.
- Guaranteed long term performance: Up to 25 years to first maintenance and overall life expectancy of up to 40 years.

**Kingspan Factory-engineered Insulated Façade Support System - 240mm K-Roc Karrier panel**

Support structure: SFS metal stud framing.

Bearing width (minimum): Minimum 130mm at vertical joints; minimum 65mm elsewhere.

Panels:

Manufacturer: [Kingspan Insulated Panels](http://www.kingspanpanels.ie)

Email: [technical.ireland@kingspan.com](mailto:technical.ireland@kingspan.com)

Product reference: [K-Roc Karrier Wall Panel \(240 mm panel thickness \)](#)

Standard:

ISO 9001, Quality Management Systems.

ISO 14001, Environmental Management Systems.

ISO 45001, Occupational Health and Safety Management Systems.

ISO 50001, Energy Management Certificate

ISO 37301, Compliance Management Systems

- Orientation: Vertical.
- Panel construction
- Panel external face
- Material: Steel.
  - Grade: ZA275 Galvalloy hot-dip zinc coated steel to BS EN 10326.
  - Profile: Flat.
  - Thickness: 0.7 mm.
- Panel internal face
- Material: Steel.
  - Grade: Hot-dip zinc coated steel to BS EN 10326.
  - Profile: Flat.
  - Thickness: 0.7 mm.
- Core insulation: Stone wool.
- Panel dimensions
- Cover width: 1200 mm.
  - Thickness: 240 mm.
- Joint type
- Side or vertical:
- Factory applied weather seal set in rebate.
  - Factory applied air seal set in rebate.
  - Bead of silicone sealant over male joints at panel ends.
- Vertical panel joints:
- Butt-jointed and weathered with a polyester based membrane fully adhered to the face of the panels.
  - The panels should be tightly butted together, any gaps to be filled with stone wool insulation (min density 23kg/m<sup>3</sup>)
  - Air seal rear of panel with bubble gasket Ref VJ1, site applied to supporting steelwork and lapped over drip flashing.
- Finish as delivered
- Outer skin
- Material: Colorcoat Prisma®.
  - Colour: Slate RAL 7012
- Inner skin
- Material: Colorcoat PE25 (standard coating).
  - Colour: Standard white RAL 9010.
- Integral accessories:
- Self-drilling, self-tapping stainless steel primary fasteners with EPDM foam spreader plate;
  - Stainless steel secondary fasteners with EPDM-backed washer;
  - Factory applied weather seals;
  - Non-curing gun grade sealant;
  - Polyester-based membrane;
  - Closed cell PVC foam tape;
  - Film-backed butyl tape.
- Fire performance
- Reaction to fire
- Core: To BS EN 13501-1, A1.
  - Panel external face: To EN 13501-1:2018, A2-s1, d0.
- U-value: 0.15 W/m<sup>2</sup>K.
- Primary fasteners: As determined by fasteners clause,
- Number and Location: As determined by attachment clause, but with each panel through fixed to each support using not less than three fasteners located evenly across the panel width, as recommended by Kingspan Facades.
- Sealing laps
- End laps:
- Factory applied weather seal set in rebate.
  - Factory applied air seal set in rebate.
  - Bead of silicone sealant over male joints at panel ends.
- Side laps:
- Factory applied weather seal set in rebate.
  - Factory applied air seal set in rebate.
  - Bead of silicone sealant over male joints at panel ends.
- Air leakage rate: <3m<sup>3</sup>/hr/m<sup>2</sup> at 50 Pa, based on the assumption that the full building envelope is constructed using Kingspan Facades.
- Additional requirements:

- Internal face of panel at panel perimeter to be air sealed along the full length by continuous runs of 20 x 6mm self-adhesive closed cell PVC foam tape site applied to supports.
- Any joints in the secondary steel frame and cleader angles, which are forming part of the building air seal line, must be sealed with a film backed Butyl tape or similar.
- Kingspan Facades recommends that the appointed cladding sub-contractor attends the appropriate product installation training course at our offices in Holywell prior to commencing installation on site.

Kingspan Facades recommends that the appointed cladding sub-contractor attends the appropriate product installation training course at our offices in Kingscourt prior to commencing installation on site.

#### General requirements

##### Design/Preparatory work

- Cladding/ covering system: Complete detailed design and submit before commencement of fabrication.
- Related works: Coordinate in detailed design.

##### Design/ performance requirements

##### Performance compliance

- Verification: Before commencing fabrication, submit evidence based on laboratory testing or computer modelling.

##### Integrity of Cladding/Covering

- Requirement: Design sheet , coverings/ flashings and methods of attachment to prevent loss of weathertightness and permanent deformation due to wind pressure or suction.
- Wind loads: Calculate wind loads to BS 6399-2.

##### 197 Attachment

Determine the number and location of cladding fasteners recommended by the cladding manufacturer to resist wind loads calculated in accordance with BS EN 1991-1-4:2005 Eurocode 1 – Actions on structures Part 1-4.

Calculate wind loads on roof and wall cladding appropriate to location, exposure, roof height, building shape and size in accordance with NA of BS EN 1991-1-4:2005 the UK National Annex to Eurocode 1

##### Water penetration

- Requirement: Under site exposure conditions, moisture must not penetrate onto internal surfaces, or into cavities not designed to be wetted.

##### Fasteners For K-Roc Karrier Behind Facade

Recommended manufacturer: EJOT, SFS INTEC, FIXFAST

Panel fasteners: Self-drilling, self-tapping screws with spreader washers.

Type(s), size(s) and drilling capacity: As recommended by fastener manufacturer to suit type and thickness of supports, and thickness of cladding panels.

Screw material: Grade 316 stainless steel.

Spreader plate material: Austenitic grade 316 stainless steel with EPDM foam

Spreader plate size: Minimum 40mm diameter.

Washer material: Austenitic stainless steel or aluminium with bonded EPDM.

Heads: Low profiled.

Fasteners for vertical joint flashings/trims: As panel fasteners.

Flashing fasteners: Stitching screws with bonded washers.

Screw/washer material: As panel fasteners.

Washer size: 14 mm diameter.

Heads: With low profiled heads to match colour of the flashing.

Fixing cladding/ roof covering

##### Fittings and accessories

- Unspecified fittings and accessories: Recommended for the purpose by the cladding/ roofing manufacturer.

##### Continuity thermal insulation

- Material: Junctions between the roof panel system and walls / penetrations insulated with stone wool insulation (min density 23kg/m<sup>3</sup>)
- Installation: Secure and continuous with cladding/ roofing insulation.

##### Profile fillers generally

- Material: MP (Metallocene polyolefin)
- Manufacturer: Premier Sealant Systems Limited
- Product references: Vieo Ridge Filler (where required at top of sheet)
- Colour: Black/White
- Thickness: 25mm
- Fixing method: Secure by Ridge Closure at top of sheet (avoid fixing through sheet to create unwanted fixed point).

- Requirement: To close cavities within the external envelope. Tight fit with no unintended gaps.
- Insulated Panel Identification & Labelling
- When the roofing and /or the wall cladding to this building is completed, a label identifying the composition of the insulated panels is to be fitted.
  - This label illustrates the type of Insulated panels fitted, to assist Insurers, Fire Officers, Owners and Occupiers identify the envelope composition.

It is a recommendation of the Kingspan QuadCore Assured Panel Warranty that the insulated panel identification label, which has a specific project registration number, is installed in an agreed location. The project architect, cladding subcontractor or owner should place / affix or communicate the positioning / placing of these labels in an appropriate and accessible location on the building.

#### EWP-004 – METAL COMPOSITE CLADDING PANEL FOR GREEN WALL SUBSTRATE

Insulated flat panel metal faced composite panel wall cladding system

Product reference: Trimo – Trimotherm FTV <https://www.trimo-group.com/en>

##### CONSTRUCTION:

- Core insulation: AST® stone wool, fibres uniformly aligned to achieve controlled strength properties.
- Core thickness: 150mm.
- Facing material: Hot dip galvanized coil-coated steel sheet.  
External sheet thickness 0.6mm.  
Internal sheet thickness 0.5mm thick.
- Factory applied weather seal.
- Module cover width: 1200mm.
- Panel lengths: Single panel lengths required to span as per elevations. 2m to 12m.
- Weight: 27 kg/m<sup>2</sup> (dead load).
- External profilation: Smooth flat finish with Shadow panel joint.
- External Coating: PVDF Spectrum RC5 50 Micrometres.
- External Colour – Refer to design drawings for RAL colour references.
- Internal profilation: Smooth flat finish.
- Internal Coating: PE Polyester 25 Micrometres.
- Internal Colour: R106 Pure White.

##### PERFORMANCE:

- Reaction to fire: A2-s1,d0 to EN 13501-1.
- Single figure weighted sound reduction  $R_w = 24$ dB.
- U-Value: 0.18 W/m<sup>2</sup>K.
- System air leakage: <3m<sup>3</sup>/hr/m<sup>2</sup> at 50Pa.
- Panels to have no cavities, gaps, cold bridges or interstitial condensation risk.
- Tolerances: Length: +8 mm, -8 mm. Width: +3 mm, -3 mm. Thickness: +3 mm, -3 mm. End squareness: +0.5 mm, -0.5 mm.
- Structural performance: Refer to manufacturer's data sheets.
- Guaranteed long term performance: Up to 25 years to first maintenance and overall life expectancy of up to 40 years.

##### ASSEMBLY:

- Refer to assembly drawings and manufacturer's site assembly instructions.
- Secondary support steelwork shall be designed in accordance with the requirements of the relevant parts of EN 1993-1-1:2005+A1:2014 Eurocode 3. "Design of steel structures. General rules and rules for buildings" where applicable, unless stated otherwise, and fixed as shown on the Drawings. Wind loads to be calculated in accordance with BS 6399-2, Standard Method and BS 5427-1 appropriate to location, exposure, height, building shape and size, taking account of existing and known future adjacent structures.  
Secondary steelwork construction must be calculated and executed in accordance with DIN 18 800. The corrosion protection of steel structures must be in accordance with DIN 55 928. The steel profiles must be prepared for paint to be applied by others. The contractor for the painting work must be advised that the profile surfaces must be cleaned and primed before being painted.  
Finish and corrosion protect supports/ cladding rails: Galvanised and/ or primed and painted in accordance with the Specification in particular Section 09 91 23 (Painting) and other relevant parts of the Specification.

- Panels to be designed to span between supports as required. Provide all support to the assemblies including all cladding fixings, having due regard for any requirements shown on the Design Drawings and in excess of primary structure shown on the Structural Engineer's Drawings.
- Concealed gaskets, secret fixed back to cladding rails including all supports and framing as required. Insulated composite panels to comprise aluminium sheet outer face and press folded galvanised mild steel or aluminium inner sheet forming a continuous vapour barrier.
- Joints in cladding shall be male and female interlocking joints on all 4 sides of panels with nominal 8-10mm panel edge black gasket extrusions (neoprene or uPVC or acceptable equivalent) for horizontal and vertical joints (i.e. horizontal and vertical joints to be of equal size).

### ALU-001 – ALUMINIUM PROFILE PANEL – CANOPY SOFFIT

Rainscreen cladding Dri-Design Cassette Panel.

#### 1.0 Contact details

Address: Kingspan Limited, Carrickmacross Road, Corgarry, Kingscourt, Co. Cavan, A82 E897.

Telephone: + 353 42 9698500

Web: [www.kingspanpanels.ie](http://www.kingspanpanels.ie)

Email: [technical.ireland@kingspan.com](mailto:technical.ireland@kingspan.com)

2.0 Primary support structure: K-Roc Karrier.

#### 3.0 Rainscreen cladding system

3.1 Manufacturer: Kingspan Insulated Panels

3.2 Product reference: Dri-Design Cassette Panel

3.3 Standard:

- ISO 9001, Quality Management Systems.
- ISO 14001, Environmental Management Systems.
- ISO 45001, Occupational Health and Safety Management Systems.
- ISO 50001, Energy Management Certificate
- ISO 37301, Compliance Management Systems

3.9 Alloy:

3.9.1 Grade: To BS EN 573-3, grade EN AW-3103.

3.9.2 Temper: To BS EN 515, H24.

3.9.3 Sheet thickness: 2 mm.

3.10 Panel size: Minimum facing size:

170 mm (H) X 390 mm (W)

Maximum facing size:

up to 610 mm (H) X 3750 mm (W)

up to 1000 mm (H) X 2000 mm (W)

up to 1220 mm (H) X 1220 mm (W)

Face width to be determined from wind loads obtained from Attachment clause.

Please contact Kingspan Tech-eXchange for further information.

3.11 Stiffeners: Bonded stiffeners factory applied to rear of cassette face as determined by project specific wind load calculations and design.

Please contact Kingspan Tech-eXchange for further information.

3.12 Finish

3.12.1 Material: Polyester Powder Coated

3.12.2 Thickness: 60 µm.

3.13 Colour: Shadow cassette: 33 mm - 100 mm deep. □ Tapered cassettes: 33 mm - 75 mm from one single edge.

3.14 Reaction to fire

3.14.1 Panel external face: Kingspan Dri-Design solid aluminium with a standard polyester powder coating (PPC) finish has a Reaction to Fire Classification of A2-s1,d0 when tested in accordance with EN 13501-1.

3.15 Panel Type:

- Flat
- Shadow
- Tapered

## 3.10.1 Cassette Depth:

- Flat: 32mm
- Shadow cassette: 33 mm - 100 mm
- Tapered cassettes: 33 mm - 75 mm from one single edge.

## 3.16 Joint Type: Vertical and Horizontal labyrinth joints.

3.16.1 Joint Width: 14mm horizontal and 16mm vertical.

## 3.17 Fasteners:

3.17.1 Number and Location: As determined by attachment clause. Cassettes are secured to the face of the panel by means of aluminium Ref: KSMR - ACM Rivet. The rivet heads may be colour coated to suit the cassette.

## PERFORMANCE:

- Reaction to fire: A2-s1,d0 to EN 13501-1.
- Single figure weighted sound reduction  $R_w = 24$ dB.
- U-Value: 0.15 W/m<sup>2</sup>K.
- System air leakage: <3m<sup>3</sup>/hr/m<sup>2</sup> at 50Pa.
- Panels to have no cavities, gaps, cold bridges or interstitial condensation risk.
- Tolerances: Length: +8 mm, -8 mm. Width: +3 mm, -3 mm. Thickness: +3 mm, -3 mm. End squareness: +0.5 mm, -0.5 mm.
- Structural performance: Refer to manufacturer's data sheets.
- Guaranteed long term performance: Up to 25 years to first maintenance and overall life expectancy of up to 40 years.

FIN-001 – EXTRUDED ALUMINIUM SOLAR SHADING SYSTEM

N/A

## 2.1 INSULATION FOR PANEL CORES

- A. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, with maximum flame-spread index of 25 and smoke-developed index of 450.
1. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
  2. The FIRE safe system shall have passed all the requirements of LPS 1181: 2005: Part 1: Issue 1.1, ceiling lining tests by the Loss Prevention Certification Board (LPCB) certified to LPS 1181 Grade EXT – B and achieve periods of fire resistance (EXT-A). This range shall achieve FM approval\* to FMRC 4880 & 4881 Class 1 fire classification, unlimited height, for wall applications.

## 2.2 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: EN 10152:2009 cold-formed metallic-coated steel sheet, EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods hot-dip galvanized, or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 1.63-mm nominal thickness.
- C. Zee Clips: As required to meet performance requirements.
- D. Base or Sill Angles / Channels: 2.01-mm nominal thickness.
- E. Hat-Shaped, Rigid Furring Channels:
1. Nominal Thickness: As required to meet performance requirements.
  2. Depth: As indicated on the drawings and in the Structural Engineer's documents and drawings.
- F. Cold-Rolled Furring Channels: Minimum 13-mm wide flange.
1. Nominal Thickness: As required to meet performance requirements.
  2. Depth: As required to meet performance requirements.
  3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet as required to meet performance requirements.
  4. Tie Wire: Class 1 zinc coating, soft temper, 1.52-mm diameter wire, or double strand of 1.22-mm diameter wire.
- G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

### 2.3 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching colour of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
- B. Backer Board: Hardboard complying with EN 622-2:2004 Class 1, 6 mm thick unless otherwise indicated.

### 2.4 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 25mm thick, flexible closure strips; cut or pre moulded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 3mm minimum thickness, zinc-coated (galvanized) steel sheet or aluminium-zinc alloy-coated steel sheet pre painted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

### 2.5 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfil indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- F. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in BS 5427:2016 that apply to the design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminium: Fabricate non-moving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminium: Fabricate non-moving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form non expansion but movable joints in metal to accommodate elastomeric sealant to comply with BS 5427:2016 standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.  
Size: As recommended by BS 5427:2016 or metal wall panel manufacturer for application but not less than thickness of metal being secured.

### 2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with BS 5427:2016 for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## SECTION 07 42 00

**PART 3 – EXECUTION**

## 3.0 WORKMANSHIP

- A. Unless specified otherwise, the installation of the works shall be carried out by roof system manufacturer approved and trained, competent installers using methods in strict accordance with the various manufacturers' written recommendations and the relevant standards.
- B. Any ancillary products or accessories, where not specified, shall be types recommended for the purpose.
- C. The manufacturer's printed instructions and installation details shall be strictly adhered to.

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
  - 3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
  - 4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to BS 5427:2016 and metal wall panel manufacturer's written recommendations.

## 3.3 METAL WALL PANEL INSTALLATION – GENERAL

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Commence metal wall panel installation and install minimum of 30 m<sup>2</sup> in presence of factory-authorized representative.
  - 2. Shim or otherwise plumb substrates receiving metal wall panels.
  - 3. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
  - 4. Install screw fasteners in predrilled holes.
  - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 6. Install flashing and trim as metal wall panel work proceeds.
  - 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  - 9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  - 10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
  - 1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
  - 2. Aluminium Wall Panels: Use aluminium or stainless-steel fasteners for surfaces exposed to the exterior; use aluminium or galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
  - 1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 (Sealants).

### 3.4 INSULATED-CORE METAL WALL PANEL INSTALLATION

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapour seal; apply sealant to panel joint on exposed side of panels for weather seal.
  - 1. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
  - 2. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
  - 3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
  - 4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  - 5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
  - 6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
  - 7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

### 3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and BS 5427:2016. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3metres with no joints allowed within 600mm of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 25mm deep, filled with mastic sealant (concealed within joints).

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent, third-party accredited qualified testing agency to perform tests and inspections.
- B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure but not less than 299 Pa. Test the weathertightness of the works using a suitable testing method as accepted by the Architect. Details of the test and a proposed method statement shall be submitted to the Architect for acceptance at least one month prior to the proposed testing on Site. All tests shall comply with the rules and standards laid down by the appropriate testing authorities.
- C. Site Hose Test: Perform hose tests on 5% of all sealed joints in accordance with the procedures prescribed in the CWCT Standard for Systemised Building Envelopes. Check for any leaks and perform repairs, replacements and additional testing and inspections as necessary.
- D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- E. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

- F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touch up or similar minor repair procedures.

### 3.8 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the damp proofing and radon protection installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s) (as noted previously).
7. Warranties: Refer to Clause No's 1.14 & 1.16.
8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE mark.

### 3.9 Rainscreen Cladding Fixings and fasteners:

3.9.1 Type and use: Reviewed and approved by manufacturers. Submit confirmatory information on request.

3.9.2 Dimensions: Not less than recommended by their manufacturers.

3.9.3 Adjustment capability: Sufficient in three dimensions to accommodate primary support structure and rainscreen cladding fabrication/ installation tolerances.

### 3.10 Rainscreen Cladding Rainscreen cladding installation

3.10.1 Tightening mechanical fasteners: To manufacturer's recommended torque figures. Do not overtighten fasteners intended to permit differential movement.

3.10.2 Protective coverings: Remove only where necessary to facilitate installation and from surfaces which will be inaccessible on completion.

### 3.11 Rainscreen Cladding Interfaces

3.11.1 Installation: Locate flashings, closers etc. correctly and neatly overlap cladding to form a weathertight junction.

**END OF SECTION 07 42 00**

**SECTION 07 50 00 – MEMBRANE ROOFING****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

To be read with the Contract, Drawings, BIM Protocol, other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

- A. This section includes roofing assemblies applied to the structural substrate, over insulation, or protected with insulation as appropriate to the particular assembly, composition and elastomeric flashing, surfacing materials, coatings, and ballast. In particular, it specifies the supply and installation of built-up insulated membrane roof coverings and associated components, as shown on the drawings.
- B. The Contractor shall test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation to the Architect's approval. To include all items necessary for full completion and finishing of the work not necessarily included.

**1.3 RELATED WORK**

Section 05 52 13 – Pipe and Tube Railings

Section 07 21 00 – Thermal Insulation

Section 22 14 00 – Rainwater Drainage

Drawings and documents of Structural Engineering and Mechanical and Electrical Consultants in relation to the refurbishment of the roof.

**1.3.1 COMPONENT / ELEMENT REFERENCES:**

ROF-020 – BUILTUP REINFORCED BITUMEN MEMBRANE WARM DECK ROOF COVERING

ROF-030 – STRUCTURAL ROOF DECKING

ROF-031 – WALKWAY PROTECTION ON ROOF PLANT AREAS

ROF-032 – NON-PENETRATIVE, FREESTANDING SUPPORTS FOR BUILDING SERVICES

ROF-033 – LIQUID WATERPROOFING SYSTEM TO FACADE UPSTAND DETAIL.

ROF-034 – EMERGENCY OVERFLOW OUTLETS (THROUGH WALL).

ROF-035 – CABLE PENETRATION UNITS.

**1.3.2 DEFINITIONS**

- A. Where the word 'Design' occurs in this document it will be described as 'Design\*'. The Asterisk implies that 'Under the design portion requirements of this specification the subcontractor is requested to take the architects design and apply their own manufacturers systems and materials performance data to comply with all criteria set out in this specification document and the architects drawings.'

**1.4 SUMMARY**

- A. This section specifies the performance requirements for built-up insulated membrane roof covering as shown on the drawings.
- B. The Roofing Contractor is to ensure compatibility of the roofing membranes and materials with those proposed for use by the Façade Contractor(s) and to ensure the integrity of the Vapour line and Air Tightness of the building is not compromised.
- C. Refer to the Structural Engineers drawings and documents for details of all structural works.
- B. The Roofing Contractor shall be responsible for the design, supply and installation of waterproof, insulated and green roofs, all fully completed and warranted. The Contractor shall be responsible for all works to the membrane insulated build-up including all falls, penetrations, thermal continuity, upstands, interfaces, joints edges, rainwater outlets, gutters and walkways. The new roof finish is to be laid to falls on tapered insulation and concrete screed roof deck laid / cast, as shown on the Structural Engineer's and Architect's drawings and described herein.
- C. The completed roof refurbishment is to comply with the requirements of the UK Building Regulations Technical Guidance / Approved Documents. The thermal performance of the completed roof is to meet and or exceed the requirements of Building Regulations 2010, Technical Guidance / Approved L, Conservation of Fuel and Energy – Buildings other than Dwellings.

- D. For full details of the thermal performance of the roofs, refer to the Thermal Model prepared by the Consultant Engineer's for the project.
- E. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

## 1.5 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT

Building Regulations 2010

BRE GROUP

Green Guide to Specification – [www.bre.co.uk/greenguide](http://www.bre.co.uk/greenguide)

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

BRITISH STANDARDS

BS 5250:2011+A1:2016 Code of practice for control of condensation in buildings

BS 6229:2003 Flat roofs with continuously supported coverings. Code of practice.

EN 13956:012 Flexible sheet for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics

EN 13707:2004 & A2:2009 Flexible Sheets for Waterproofing – Reinforced Bitumen Sheets for Roof Waterproofing.

EN 1991-1-4:2005+A1:2010 Eurocode 1. Actions on structures. General actions. Wind actions

BS 80000:2014 Workmanship on construction sites. Introduction and general principles

BS 8217:2005 Reinforced bitumen membranes for roofing. Code of practice

EN ISO 13788:2012 Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation.

Calculation methods

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)

Guide Choosing construction products: Guide to the recycled content of mainstream construction products. Version 4. 2008.

## 1.6 DESCRIPTION OF INSULATED ROOF MEMBRANE SYSTEM

- A. The complete Roof Installations shall be installed in accordance with the UK Building Regulations.
  - 1. Single-ply mechanically fastened flat roof systems (warm roof) – consisting of a polyester reinforced, multi-layer, synthetic roof waterproofing sheet based on premium-quality flexible polyolefins (FPO) containing ultraviolet light stabilizers, flame retardant and an inlay of glass non-woven according to EN 13956. The substrate surface must be uniform, smooth and free of any sharp protrusions or burrs, etc. The supporting layer must be compatible to the membrane, solvent resistant, clean, dry and free of grease and dust. The waterproofing membrane is to be overlaid with the full insulation system, designed for the project, comprising high performance glass tissue faced flat board PIR insulation over a vapour control layer. Insulation to be tapered where required and with vertically fitted glass tissue faced board PIR insulation to all upstands, kerbs, perimeters, etc. PIR board insulation of high compressive strength is to be applied to designated areas of the roofs where additional loadings are anticipated. Insulation to be set in cold applied adhesive and mechanically fixed in accordance with the requirements of the wind load calculations to be completed by the Contractor and submitted to the Architect and Structural Engineer.
  - 2. Modified bitumen membrane insulated roof systems (warm roof) – consisting of modified bitumen base sheet, bonded / applied appropriately to the pre-primed substrate, which has been laid / cast as shown on the drawings. The base sheet is to be overlaid with the full insulation system, designed for the project, comprising high performance glass tissue faced flat board PIR insulation over a vapour control layer. Insulation to be tapered where required and with vertically fitted glass tissue faced board PIR insulation to all upstands, kerbs, perimeters, etc. PIR board insulation of high compressive strength is to be applied to designated areas of the roofs where additional loadings are anticipated. Insulation to be set in cold applied adhesive and mechanically fixed in accordance with the requirements of the wind load calculations to be completed by the Contractor and submitted to the Architect and Structural Engineer.  
The insulated roof system is to be overlaid with interply sheet and cap sheet. Modified bitumen roof membrane must be torch applied.  
All works must follow the Architect's and / or membrane manufacturer's drawings, specifications, guidelines and the standards stated within this Section.
- B. The work includes, but is not necessarily limited to, the following:
  - 1. High performance insulated membrane roofing system.
  - 2. All items related to the above including but not limited to base layers, primers, vapour control layers, wearing sheets and all associated membranes, trims etc.

3. All flashings, fixings and finishes.
4. Thermal insulation and / or tapered thermal insulation, thermally broken mechanical fixings.
5. Verification of Slab laid to falls required and advise the Main Contractor of any discrepancies and required remedies prior to commencement of works.
6. Flashings and counter flashings as necessary.
7. Safety Anchors / Fall Restraint System and Freestanding Guard Rail System.
8. Rainwater outlets and downpipes, all to be insulated internally.
9. Designated walkways / Walk on paving.
10. Ballast stones / gravel.
11. Step over ladders/Steps.
12. Lightning Protection.
13. Rainwater drainage outlets, associated leak detection (testing and commissioning), overflow pipes.
14. Weathering and thermal insulation to all roof penetrations.
15. Movement / Expansion Joints (where required). Refer to the Structural Engineer's drawings for locations.
16. Fire sealing and protection measures.
17. Parapet upstand insulation, waterproofing and interface with metal parapets.
18. Interfaces and sealing details at all junctions with the façade and other external wall constructions to ensure that the vapour and thermal line of the building is maintained throughout.
19. Dressing up to and sealing to adjacent and related installations including the External Envelope, all Mechanical and Electrical works.
20. Fixing plates, brackets, angles to be included, and attachments.
21. Drilling of structural steel and concrete as necessary and approved by the Structural Engineer.
22. Finishes to all exposed external and internal surfaces.
23. All Tests to be performed to ensure the roof meets the performances required.
24. Builders work in connection with the installation.
25. Provision of Safety, Prohibition, Warning, Mandatory signage to the roof, in accordance with the requirements of S.I. No. 229 of 2007 Safety, Health and Welfare at Work (General Application) Regulations 2007.
26. Weathering and the completion of the interface between the roofs and all adjacent installations.
27. Craneage will be carried out by the work package contractor.
28. It will be the responsibility of the work package contractor to re-cycle their own waste in an environmentally responsible manner.
29. Professional Indemnity Insurance for design of all systems.
30. All elements to achieve Firestopping requirements.
31. Certification of Sustainability standards.
32. Certification that the building has been constructed in accordance with the requirements of the UK Building Regulations.
33. Cleaning the installations.
34. Provision of Samples and Mock-ups.
35. Maintenance and servicing of the entire roofing installation for a period of 2 years after completion of the defects period.
36. All items not necessarily shown on the drawings or described in the specification required for the proper completion of the works.

#### 1.6.1 SUSTAINABILITY SUBMITTALS

Comply with applicable national VOC control regulations, such as the European Decopaint Directive (2004/42/EC).

#### 1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  1. Product Test Reports: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
  2. Product Data: For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
  3. Laboratory Test Reports: For adhesives and sealants used inside the weatherproofing system, all products should be tested against EN 139991: 2007.  
Carcinogenic or sensitizing volatile substances should be absent when tested to EN 139992:2007 – VOCs, EN 139993:2007 – Volatile Aldehydes and EN 139994:2007 – Volatile Diisocyanates.  
The contractor is to include as part of the tender process, written evidence from product manufactures confirming that Carcinogenic or sensitizing volatile substances are not present

when tested to EN 139992:2007 – VOCs , EN 139993:2007 – Volatile Aldehydes and EN 139994:2007 – Volatile Diisocyanates.

4. All insulation should be responsibly resourced and have an EMS covering the Key Process and Supply Chain Process identified on the EMS Criteria. Copies of all relevant EMS certificates are to be included as part of the tender process.

Roof Insulation: To Achieve an BRE A 2008 Environmental Profile Rating for Offices.

5. SHOP DRAWINGS: Include roof plans, elevations, sections, details, and attachments to other work. Show on the drawings, full details of insulation board layout including tapered board to all areas where required including gutters.
6. Samples for Verification: For all components, including but not limited to membrane cap sheet and, gravel, of colour specified.

#### 1.8 INFORMATION SUBMITTALS

- A. Research/evaluation/ compliance reports.
- B. Documentation of manufacturer's takeback programme for unused product. Include the following:
  1. Appropriate contact information.
  2. Overview of procedures.
  3. Identify manufacturer's policy for collection or return of remaining unused material and packaging material.  
Identify manufacturer's commitment to recycle and / or reuse reclaimed materials.
  4. Limitations and conditions, if any, applicable to the project.
  5. Maintenance data for inclusion in the Building Operations and Maintenance manual.

#### 1.9 TENDER SUBMITTALS

The following details for each roof type at scale 1:5 and samples are required at the time of tender: -

1. Proposed parapet upstand details.
2. Proposed expansion joint.
3. Proposed Roof opening upstand / kerbs.
4. Proposed roof safety system – details for entire system.
5. Proposed rainwater outlet detail including all types of outlets proposed.
6. Proposed roof build-up(s).
7. Details and typical cost for roof and safety system maintenance.
8. Proposed roof outlet scupper detail.
9. Requirements for fire-rated and non fire-rated construction, requirements to achieve correct U-value and loadings including wind loadings.
10. Design, fabrication, supply and installation programme to be co-ordinated with General Contractors programme.
11. Test certificates demonstrating compliance to the tests described below.
12. Test certificates to demonstrate compliance with local code in terms of fire rating of the materials and proposed assemblies.
13. Copy of proposed warranty documentation.

##### 1.9.1 DRAWINGS

- A. Submit shop drawings to the Architect showing how the different types of roof finishes are to be installed, indicating specifically how the requirements of this specification are met.
  1. Scale shall be not less than 1:20, details at 1:5.  
Plans, sections, elevations and sections as required to fully illustrate the proposal.

##### 1.9.2 PROPOSED MATERIALS, FINISHES AND SUPPLIERS

- A. Provide with the submission, a list of proposed materials and finishes and their source for all material or materials procured from suppliers or Subcontractors to the Architect, state the name and address of the supplier, and any other documents which may be required by the Project Team as evidence of their ability to carry out the tasks expected of him.

##### 1.9.3 INFORMATION PROGRAMME

- A. Provide with the submission, a programme (over and above the protection and erection programme required by the General Contractor) which shows the proposed drawing list, date for issue and date for approval by the Architect for the entire contract works.
- B. The Architect reserves the right to amend the Subcontractor's information programme in order to ensure the satisfactory flow of information to other Subcontractors or members of the Project Team irrespective of when information is needed by the Subcontractor for his own production programme.

#### 1.9.4 METHOD STATEMENT

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

#### 1.9.5 UNSPECIFIED MATERIALS

Submission should include, a list of all materials proposed which are not specifically described in this specification. Submit manufacturers' data and identify proposed location and junction and demonstrate compliance.

#### 1.10 QUALITY ASSURANCE

1. All projects with more than 1,400 square metres of roof area or which is defined as critical use or mission critical in the project shall have a Registered Roof Consultant (RRC) or a registered professional engineer (PE) who derives his or her principal income from roofing design on the quality control staff of the roof membrane system manufacturer.
2. The manufacturer(s) of all installed products to the project is, upon completion of the works to provide written certification that all products are installed in accordance with their instructions, and in accordance with the UK Building Regulations Technical Guidance / Approved Documents 2010, all current National and European Codes of Practice and Standards and the requirements of this, the Specification prepared for the project.

#### 1.11 QUALIFICATION OF MANUFACTURER AND APPLICATOR

1. Modified bitumen sheet roofing system manufacturer must have a minimum of 10 years' experience in modified bitumen roofing products.
2. Roofing system applicator must be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and have a minimum of five years' experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator must supply the names, locations and client contact information of five projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

#### 1.12 QUALIFICATION OF ENGINEER OF RECORD

Engineer of Record must be currently licensed within the jurisdiction of the project. Engineer of Record must be approved, authorized, and currently licensed by the Institution of Engineers of Ireland (IEI), and have a minimum of five years' experience as an approved Engineer for manufacturers of similar roof systems.

Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. Engineer of Record must provide certified engineering calculations for:

Project specific wind uplift calculation requirements in accordance with UK and European codes.

#### 1.13 PERFORMANCE REQUIREMENTS

Comply with the following specific performance requirements whilst maintaining the aesthetic / visual intent and dimensional constraints indicated on the Architect's drawings.

##### 1.13.1 WATERTIGHTNESS

The installation shall ensure the absolute prevention of water leakage inside the building through the roof finishes, abutments with adjacent works, penetrations for services and all interface conditions.

Ensure that the waterproof membrane(s) are/ is laid to a minimum of 1:60 falls.

Provide all drainage outlets and provide flow rate calculations to demonstrate that the design rate of rainfall is accommodated to EN 12056: Part 3 and / or BS 8490:2007 'Guide to Siphonic Roof Drainage Systems'. Refer to the Service Engineer's Specifications and Drawings.

All roof finishes shall be installed such that no track migration of water is possible beneath the principal waterproofing membrane.

All waterproof membranes shall form continuous waterproofing barriers fully bonded to their substrates.

Ensure that all roof outlets are suitable/ compatible for the roofing membrane(s) used.

### 1.13.2 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

The average thermal transmittance (U value) for the completed roof works shall be 0.15 W/m<sup>2</sup>K and shall meet and or exceed the U Value as advised by the Thermal Model / Consultants.

### 1.13.3 STRUCTURE, MOVEMENTS AND DEAD LOADS

The roof coverings shall be capable of accommodating the following movements without any permanent deformation or reduction in the specified performance:

- i) Due to deflection under design loads.
- ii) Due to the effects of repeated wind loading.
- iii) Due to changes in dimension and shape of components arising from building movements, including settlement, creep, twisting and racking.

Reference shall be made to the Structural Engineer's Specifications and Drawings for the anticipated movement of the Building Structure and relevant elements. The precise characteristics of the adjacent structures and any provision for structural support in the works shall be ascertained.

The detailed design shall take account of all structural criteria and ensure that the works take account of all movement and tolerances in both permanent and temporary conditions, in order to avoid stress or deformation under these conditions.

Ensure that the structure, into which the works are being installed, including tolerances and deflections, is suitable. This shall be verified at all stages of the works.

### 1.13.4 MOISTURE MOVEMENT

The roof coverings shall withstand the following movement without permanent deformation or any reduction in the specified performance:

- i) Due to changes in the moisture content of their components.
- ii) Due to the expansion of absorbed or retained moisture caused by freezing.

### 1.13.5 ATTACHMENT/ WIND LOADS

The Contractor shall design/ select the method(s) of attachment of the roofing system to withstand, without permanent deformation, the positive and negative effects of wind loads on the roofing, to the Structural Engineer's and Architect's approval.

Ensure that the method(s) of attachment make sufficient provision for relative movement of materials and effects of vapour pressure, do not perforate covering, and do not reduce performance of vapour control layer below that required.

Submit licensed engineer's Wind uplift calculations and substantiating data to validate any nonrated roof system.

Membrane linings for gutters shall be designed to resist wind uplift. Fixing details to be agreed with the Architect.

### 1.13.6 LIVE/ IMPOSED LOADS

The roof coverings (all aspects of the waterproofing system) to the areas of roofing shall be capable of accommodating the following live loads without any reduction in performance for the design life specified. Select materials to suit the following loading conditions:

- i) Wind loads.
- ii) Vertically applied loads acting on the surface of the roof finishes arising from maintenance and cleaning operations to EN 1991-1-3:2003+A1:2015 Eurocode 1. Actions on structures. General actions. Snow loads.

### 1.13.7 FIRE PERFORMANCE

Membrane shall meet category AA to BS 476: Part 3.

Complete roof covering assembly must:

External areas shall meet unprotected limitations under requirement 'External Fire Spread' in Technical Guidance / Approved / Approved Document Part B of the Building Regulations.

### 1.13.8 HEIGHTS AND LEVELS

Refer to the Architect's drawings for the height restrictions in relation to the roof build-up. The tapered roof insulation shall be manufactured to provide falls of 1:60.

### 1.13.9 PENETRATIONS

Refer to the Architect's drawings for locations and extent of penetrations through the insulated waterproofing to the roof. Penetrations are to be detailed and installed to ensure the waterproofing and thermal continuity of the roof are not compromised in any way.

#### 1.13.10 LIGHTNING PROTECTION

Flash and attach lightning protection system components to the roof membrane in a manner acceptable to the Architect and roof membrane manufacturer. Refer to Consultant Engineers for details on the Lightning Protection Strategy for the project.

#### 1.13.11 AVOIDANCE OF INTERSTITIAL CONDENSATION: WARM AND INVERTED ROOFS

Interstitial condensation within roof construction: Determine risk as recommended in BS 5250 and EN ISO 13788.

Vapour control layer: To be provided to all roofs, a suitable membrane so that damage and nuisance from interstitial condensation do not occur. Proposal to be agreed with Architect.

#### 1.13.12 SLIP RESISTANCE.

The Roof Waterproofing System shall have a 'Low' slip resistance potential when laboratory tested in accordance with UK Slip Resistance Group Guidelines (UKSRG) 2011.

#### 1.13.13 AIRTIGHTNESS

The Roof waterproofing system shall be certified Airtight to 0.05 m<sup>3</sup>/hr/m<sup>2</sup>@ 50Pa by an INAB Accredited Testing Laboratory, under testing to the following standards:

CIBSE TM23 2000

EN 13829 2001

BS: EN 13141

ATTMA Technical Standard 1 '2007'

#### 1.14 PRE ROOFING CONFERENCE

After approval of submittals and before performing roofing and insulation system installation work, hold a pre-roofing conference to review the following:

- A. SHOP DRAWINGS – including plans, elevations, sections, details, and attachments to other work, specifications and submittals related to the design supply and installation of roof work.
- B. FIELD INSPECTION AND VERIFICATION OF ALL EXISTING CONDITIONS – including all fire safety issues, existing structure, and existing materials, including concealed combustibles, which may require additional protection during installation.
- C. Roof system components installation.
- D. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roof structure, and roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representatives to roof manufacturer.
- E. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing.
- F. Quality control, plan for the roof system installation.
- G. SAFETY REQUIREMENTS – Coordinate pre-roofing conference scheduling with the Contracting Officer.

The conference must be attended by the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, Mechanical and electrical work, other trades interfacing with the roof work, designated safety personnel trained to enforce and comply with ASSE/SAFE A10.24, Fire Marshall, and representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

#### 1.15 DELIVERY, STORAGE AND HANDLING

##### A. DELIVERY

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container must bear the specification number, type, and class, as applicable.

Deliver materials in sufficient quantity to allow work to proceed without interruption.

##### B. STORAGE

Protect materials against moisture absorption and contamination or other damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 10 degrees C 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off

roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof.

Provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work.

Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

Maintain a minimum distance of 10.67 metres for all stored flammable materials, including materials covered with shrink wraps, craft paper and/or tarps from all torch/welding applications. Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

C. HANDLING

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials or applied roofing.

1.16 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 4.44 degrees C 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Follow manufacturer's printed instructions for Cold Weather Installation.

1.17 TORCH APPLIED (HEAT WELD) MODIFIED BITUMEN MEMBRANE SAFETY

A. PROPERTY PROTECTION

Take all precautions necessary to prevent ignition of combustible materials during torch application of roofing.

Immediately call the fire department if a fire commences. Review all fire procedures as outlined at the pre-roofing conference.

Install materials using the techniques recommended by the membrane manufacturer.

Do not store flammable liquids on the roof.

Provide a minimum of two 10 litre containers of water and two fully charged minimum 9.072 kg CO2 (dry chemical) fire extinguishers in separate, easily accessible locations on the roof and within 10 metres of each torch work area at all times.

Comply with the following safety procedures:

1. Fuel containers, burners, and related appurtenances of roofing equipment in which liquefied petroleum gas is used for heating must comply with the requirements of NFPA 58.
2. Fuel containers having capacities greater than one pound must be located a minimum of 3.0 metres clear distance from the burner flame.
3. All LP Gas Cylinders must be clearly labelled 'Flammable Gas', and secured to prevent accidental tip over.

B. FIRE WATCH

All personnel on the roof during torch application must be properly trained to use a fire extinguisher. Provide a fire watch for a minimum of two hours after completion of all torch work at the end of each work shift. Maintain the fire watch for additional time required to ensure no potential ignition conditions exist.

For torch applications, provide and utilize a minimum of one certified heat detection gun per torch for use during the fire watch to verify cool, safe and non-combustible conditions exist. Provide a minimum duration fire watch of two hours conducted by personnel properly trained to survey the underside of the roof deck (where possible) and the topside of possible smouldering elements.

Do not torch in areas of poor and/or no visibility (curbs, corners, eaves, expansions joints, flashing, other voids and small penetrations) which could allow a torch flame to ignite combustible material(s) hidden from view or within the underside of the roof deck or building interior. Use cold finish applications in these areas whenever possible and per manufacturer's printed instructions.

Do not leave the rooftop unattended during breaks in work during a work shift. Walk and scan all areas of application checking for hot spots, fumes, or smouldering, especially at wall and curb areas, prior to departure at the end of each work shift. Ensure any and all suspect conditions are eliminated prior to leaving the site each work shift.

C. WIND CONDITIONS

Use side shields with all torching operations when winds are occurring to prevent flame distortion of end burners. Use torch machine equipment with bottom shield plate to prevent flame spread on to roof deck and substrate.

When high wind gusts are present, notify the safety officer and cease all use of torching equipment until wind conditions lower and authorization from the safety officer to proceed is received.

### 1.18 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counter flashing, per manufacturer's details, and are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. Application of roofing must immediately follow application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.

### 1.19 ROOF MEMBRANE MANUFACTURER'S WARRANTY

Furnish the roof membrane manufacturer's 20 year, insurance backed, no financial limit roof system materials and installation workmanship warranty, including waterproofing, flashings, insulation, all junctions and interfaces and all accessories necessary for a watertight roof system construction.

Provide the warranty directly to the Client and commence warranty effective date at time of Client's acceptance of the roof work. The warranty must state that:

- A. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer.
- B. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.
- D. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.
- D. Upon completion of installation, and acceptance by the Architect, Client's Representative and Roofing System Engineer of Record, the manufacturer must supply the appropriate warranty to the Owner.
- E. A 20 year product, workmanship, design, consequential damages and pure financial loss guarantee is to be provided upon completion following a Final Inspection by the roof membrane's representative.

#### 1.19.1 ROOFING SYSTEM INSTALLER WARRANTY

The roof system installer must warrant for a period of twenty years that the roof system, as installed, is free from defects in installation workmanship, to include the bituminous roof covering, flashings, insulation and all junctions and interfaces, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Client. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials.

The roof system installer is responsible for all costs associated with the repair or replacement work.

#### 1.19.2 CONTINUANCE OF WARRANTY

Repair or replacement work, that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

### 1.20 CONFORMANCE AND COMPATIBILITY

The entire insulated roofing, and flashing system must be in accordance with specified and indicated requirements, including fire and wind resistance (BS 8217:2005 Reinforced bitumen membranes for roofing. Code of practice) requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the NRCA Roofing and Waterproofing Manual, membrane manufacturer published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

### 1.21 DECLARATION OF CONFORMANCE

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
- The performance requirements for the project.
- The technical specifications standards described herein.

#### 1.22 SINGLE SOURCE WARRANTY

All components and 'build-up of components' shall be covered by a single source, insurance backed warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified. All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions.

Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Architect.

#### 1.23 SUSTAINABILITY REQUIREMENTS

White capsheet/external finish. Solar Reflectance Index (SRI) > 80.

#### 1.24 ROOF MEMBRANE SYSTEM MANUFACTURER'S PROVISION OF ON SITE TRAINING

The Roof Membrane System manufacturer(s) is to provide 'toolbox talks' on site, on appropriate installation and fixing requirements for the insulated membrane roof to be installed.

The Contractor shall demonstrate the Roof Membrane System manufacturer has visited site and provided Instruction on correct installation for each type specified.

Inspections: Roof Membrane System manufacturer(s) to inspect installation of each membrane and component type (frequency of such site visits to be agreed with the Architect and the Client's Representative) to ensure appropriate and correct installation(s) and complete an inspection report for each visit.

Verification: The Roof Membrane System manufacturer(s) to verify correct installation of each roof component type.

Warranty: Roof Membrane System manufacturer(s) to provide Project Specific Performance Warranty upon completion of the installation of the roofing types.

The Architect will not accept installations / applications of insulated Roof membrane System which have not been approved by the Roof Membrane System manufacturer(s).

#### 1.25 TESTING REQUIREMENTS

The Contractor shall include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

The provision of testing data or the carrying out of tests does not relieve the Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.

#### 1.26 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the demountable partition installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s).
7. Warranties: Refer to Clause No 1.19.
8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

## 1.27 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
1. ISO 14001 Environmental Management Systems certification.
  2. Validation according to the Eco Management and Audit System (EMAS).
  3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

SOPREMA Ireland, Unit 75 Cookstown Industrial Estate, Tallaght, Dublin 24  
Tel: +353 (0)1 405 77 96. E-mail: info@soprema.ie

Moy Materials Ltd., Unit K, South City Business Park, Whitestown Way, Tallaght, Dublin 24.  
Tel: +353 (0)1 451 9077. www.moymaterials.com.

Kingspan Insulation Ltd., Bree Industrial Estate, Castleblayney, Co. Monaghan

SIKA IRELAND LIMITED, Sika House, Ballymun Industrial Estate, Dublin 11  
Tel: +353 (0)1 862 0709. Fax: +353 (0)1 862 0707.

IKO Ltd., Unit 502 Northwest Business Park, Ballycoolin, Dublin 15,  
Tel: +353 (0)1 885 5090. Fax: +353 (0)1 885 5858. E-mail: waterproofing@iko.ie

Walraven., Thorpe Way, Banbury, Oxfordshire OX16 4UU, UK  
Tel: +44 (0)1295 753400. Email: sales.uk@walraven.com

Big Foot Systems Ltd., Apex Way, Hailsham, East Sussex, BN27 3WA, UK  
+44 (0)1323 844 355. +44 (0)1 323 844 959. enquiry@bigfootsupport.com

Latchways PLC., Hopton Park, Devizes, Wiltshire, SN10 2JP, UK  
Tel: +44 (0)1380 732700. Fax: +44 (0)1380 732701. Email: info@latchways.com

Harmer, Alumasc, Station Road, Burton Latimer, Kettering, Northamptonshire, NN15 5JP. UK  
Tel: +44 (0)1536 383810. Fax +44 (0)1744 648401. www.alumascrainwater.co.uk

## SECTION 07 50 00

**PART 2 – PRODUCTS****ROF-020 – BUILTUP REINFORCED BITUMEN MEMBRANE WARM DECK ROOF COVERING**

Built-up reinforced bitumen membrane warm deck roof waterproofing system.

Reference Product: Soprema Multi-Ply modified bitumen membrane system, as described below.

FM Build-up reference: 422511-422510-0

- A. **SUBSTRATE:** Concrete Slab / Metal Deck to Structural Engineer's Specification.  
Roof structure / substrate generally built to minimum required falls to provide positive drainage. Tapered insulation to be used where required. Refer to design drawings and documents.
- B. **PREPARATION:** The substrate surface must be uniform, smooth and free of any sharp protrusions or burrs, etc. The supporting layer must be compatible with the system, solvent resistant, clean, dry and free of grease and dust. Apply primer as recommended by supplier – ELASTOCOL 600.
- C. **APPLICATION:** The Soprema modified bitumen membrane system comprises:
  - Sopralene Global C3 48 GF 4.8mm Cap Sheet.
  - Soprarock Global SBS 30 TF 1/12 Base Layer.
  - Sopraboard 3.2mm Asphaltic Cover Board.
  - Xtratherm Thin-R PIR Insulation and tapered insulation where required.
  - Sopravap Stick A15-Vapour Control Layer.

Bituminous torch-on roofing membranes should be installed in accordance with BS 8217: 2005, Code of Practice for Reinforced bitumen membranes for roofing, and to manufacturer's specifications. The application should follow the recommended good practices for torch-applied membranes. Care must be taken when applying torch-on membranes in close proximity to combustible materials, decorative coatings and heat sensitive materials.  
Apply torch-on roofing by propane gas torch, melting the heat dispersible backing and coating to create a molten flow in front of the roll. The flame of the torch should be applied at the low point where the roll meets the underlay. As the film and bitumen melts, roll the roofing forward. Side joints in the sheets should be fully bonded and joints between panels should allow an overlap of 8-10 cm for lateral joints and 12-15 cm for head joints. Care must be taken when using torch applied membranes in close proximity to combustible materials, decorative coatings and heat sensitive materials. A bead of bitumen must exude from all lap joints to ensure a seal.  
Air tightness: <0.03 M3/Hr @ 50Pa
- D. **WATERPROOFING MEMBRANE (Cap Sheet):**  
Sopralene Global C3 48 GF - FM Grade, granular surfaced, elastomeric modified bitumen with fire retardant additives and a composite polyester reinforcement.
  - Thickness: 4.8mm
  - Exposed surface: White, high SRI surface granule.
  - Lower surface: Thermofusible film.
  - Mass (indicative): 6.2 kg/m<sup>2</sup>
  - Elastic low temperature flexibility: ≤20°C (EN 1109)
  - High temperature dimensional stability: ≥100°C (EN 1110)
  - Watertightness: ≥10 kPa/24 h (EN 1928)
  - Tensile force N/50 mm (L / T): 1300 / 1000 ± 20 % (EN 12311-1)
  - Elongation at max. tensile force (L / T): 35% / 35% ± 15 (EN 12311-1)
  - Resistance to static loading: ≥ 20kg (EN 12730-A), ≥ 15kg (EN 12730-B)
  - Resistance to impact: ≥ 1250mm (EN 12691-A), ≥ 1750mm (EN 12691-B)
  - Dimensional stability: ≤ 0,3% (EN 1107-1)
  - Resistance to tearing (nail shank) (L / T): 370N / 370N ± 25 % (EN 12310-1)
  - SRI (Solar Reflectance Index): ~80
  - 89/106/EEC Construction Products Directive.
  - EN 13707: Flexible sheets for waterproofing-Reinforced bitumen sheets for roof waterproofing.
  - CE Marking in accordance with harmonised European Standards EN 13707: 2013
- E. **UNDERLAY MEMBRANE:**  
Soprarock Global SBS 30 TF 1/12 Base Layer - Elastomeric modified bitumen with composite polyester reinforcement.
  - Thickness: 3mm
  - Upper surface: Talcum/sand.
  - Lower surface: Thermofusible film.
  - Mass (indicative): 3.7 kg/m<sup>2</sup>
  - Elastic low temperature flexibility: ≤20°C (EN 1109)
  - High temperature dimensional stability: ≥110°C (EN 1110)

- Tensile force N/50 mm (L / T): 650 / 450 ± 20 % (EN 12311-1)
  - Elongation at max. tensile force (L / T): 35% / 35% ± 15 (EN 12311-1)
  - Dimensional stability: ≤ 0,3% (EN 1107-1)
  - Resistance to tearing (nail shank) (L / T): 170N / 170N ± 25 % (EN 12310-1)
  - 89/106/EEC Construction Products Directive.
  - EN 13707: Flexible sheets for waterproofing-Reinforced bitumen sheets for roof waterproofing.
  - CE Marking in accordance with harmonised European Standards EN 13707: 2013
- F. PROTECTIVE BOARD: Sopraboard Asphaltic Cover Board - composed of two asphalt-saturated glass mat reinforcement covering a mineral-fortified asphaltic core. Adhered with Duotack adhesive and/or mechanically fastened to steel deck with screws and stress plates for insulation.
- Thickness: 3.2 mm
  - Weight: 4.4 kg/m<sup>2</sup>
  - Puncture resistance: 500 N
  - Water absorption: 2.5 %
  - Compressive Strength: ≥ 1641 kPa
- G. INSULATION:  
Xtratherm Thin-R (PIR) flat roof insulation rigid polyisocyanurate foam board for use on flat roofs, in a torched application in combination with bituminous and plastic membranes. Part of the Soprema modified bitumen membrane system build-up. Manufactured in accordance with EN ISO 9002 : 1994.
- Upper surface: Polypropylene fleece finished bitumen/glass fibre working surface.
  - Lower surface: Mineral glass facing.
  - Cross section: Uniform thickness.
  - Board thickness (nominal): As per design drawings and calculations to achieve required u-value as set out in Part L report.
  - Typical Density of 32kg/m<sup>3</sup>.
  - Compressive strength >150 kPa at 10% deformation to EN 826:1996.
  - Thermal conductivity: 0.020W/mK (thicknesses >120mm).
  - Reaction to fire: To EN 13501-1, class F.
  - CFC/ HCFC-free.
  - Blowing agent with zero ODP (Ozone Depletion Potential).
  - Face size (length x width): Maximum 1200mm x 1200mm
- Install tightly butt joined and staggered in accordance to manufacturer's details. Fully Bitumen bonded in approved bitumen compound to system vapour control layer.
- H. VAPOUR CONTROL:  
Sopravap Stick A15 Vapour Control Layer. Self-adhesive membrane composed of elastomer modified bitumen and a composite aluminium reinforcement.
- Thickness: 1.5mm
  - Upper surface: Talcum/sand.
  - Lower surface: Silicone release film.
  - Reinforcement: Aluminium composite.
  - Coating mass: Self-adhesive elastomer modified bitumen.
  - Mass (indicative): 1.5 kg/m<sup>2</sup>
  - Elastic low temperature flexibility: ≤20°C (EN 1109)
  - High temperature dimensional stability: ≥100°C (EN 1110)
  - Water vapour diffusion-equivalent: 410m +20 % (EN 1931)
  - Tensile force N/50 mm (L / T): 760 / 660 ± 20 % (EN 12311-1)
  - Elongation at max. tensile force (L / T): 2% / 2% ± 3 (EN 12311-1)
  - Resistance to tearing (nail shank) (L / T): 150N / 150N +50% (EN 12310-1)
- I. SURFACE PROTECTION: Refer to manufacturer's instructions. Construction traffic on the unprotected roofing membrane is not permitted.
- J. ACCESSORIES:
- Rainwater Outlets: Soprema scupper roof outlet, 150mm, complete with proprietary threaded connection to spigot, sized in accordance with project specific rainwater design calculations to EN 12056. Cast in LM6 Aluminium Silicone Alloy to BS 1490:1988. Sized and supplied by waterproofing system manufacturer and incorporated in total roof system warranty.
  - Roof-Pro Lite Anchor Lightning Conductor Pads @ 1.00m centres.
  - Roof Pro PP3 and Roof Nek Units to cable penetrations.
  - Flexjoint EP 40 Expansion joint strip.
  - All roof plinths, parapets, thresholds, upstands, installations and services penetrations to be waterproofed following roof system manufacturer's instructions.

**ROF-030 – STRUCTURAL ROOF DECKING**

Structure deep deck steel roofing profile.

(NOTE: Design reference only – Structural Engineers' specification takes precedence)

- Manufacturer: Tata Steel
- Product reference: Structural Roof Decking Profile D100.
- Material: Steel, 1.20mm gauge.
- Finish: Hot dip galvanized zinc coated steel to EN 10326.
- Installation: To manufacturer's guidelines and Structural Engineers' detail and specification.

**ROF-031 – WALKWAY PROTECTION ON ROOF PLANT AREAS**

Reinforced Bitumen Roof: Roof walk pads must be polyester reinforced, granule surfaced modified bitumen membrane material, minimum 5 mm thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Panels must not exceed 1200mm length. Factory cut at 500mm width, to walkways and areas as noted on design drawings. Finish Terracotta Red to ensure colour contrast.

**ROF-032 – NON-PENETRATIVE, FREESTANDING SUPPORTS FOR BUILDING SERVICES**

Building services and associated equipment situated on areas of flat roofing should be supported on a proprietary modular supporting system, including freestanding, galvanised steel strut frame assemblies and freestanding ballasted feet.

Product reference: Walraven BIS Yeti 480 Support System.

Support frames must not penetrate the roof waterproofing membrane, but should facilitate easy access to the roof waterproofing for the purpose of future repair and renewal by others. Support frames should elevate all building services and associated equipment above the roof waterproofing membrane. Due consideration should be given to appropriate load management for the roof build-up, and manufacturer's load management calculations to be submitted for the structural engineer's approval.

Type: Non-penetrative, freestanding supports for all roof mounted building services, including: AHUs, chillers, condensers, extract fans, ducts, pipes, cable trays & ladders, plant rooms, tanks, generators, access step overs & platforms, solar panels, lighting poles, etc..

Height: minimum recommended clearance under all services of 450-500mm. May be reduced to accommodate final plant heights in accordance with Architects drawings.

Support Legs: pivoting and threaded support legs and bases, as appropriate to the building services being supported and the roof build-up.

Finish: hot dip galvanised steel strut frames; and moulded WPC/polypropylene bases.

Documentation required by Project Team for approval:

- Project-specific design information including building clearance, support stability and load management calculations – for the structural engineer's approval.
- Product Certification.
- O&M Documentation.
- Product Warranty.

**ROF-033 – LIQUID WATERPROOFING SYSTEM TO FACADE UPSTAND**

Applicable to concrete / concrete block façade upstands at ground level and core walls at roof level. Preparation: Ensure surfaces are clean and dry, abrade smooth metallic surfaces. Any gaps to be filled with compatible product. (Cement Mortar).

Priming; Apply Enke universal primer to prepared surface as per manufacturer's installation guidelines. Curing time depends on ambient temperature and the minimum air and substrate temperature should be +5 and rising. Curing time is approximately 40 minutes.

Waterproofing; Ensure primed surface is fully cured before application of the Enkopur resin and reinforcement fleece. Roller or brush apply Enkopur PUR Resin to primed surface at a ratio of 2kg per square meter. Lay pre-cut reinforcement fleece into wet resin and rub out with a dry roller to ensure the fleece is embedded into the Enkopur resin. The fleece will begin to absorb the resin and change Colour after approximately 1 minute. Apply a second coat of Enkopur PUR to the top surface of the fleece to ensure the fleece is fully saturated.

The finished application shall be shower proof after approximately 45 minutes.

**ROF-034 – EMERGENCY OVERFLOW OUTLETS (THROUGH WALL)**

Proprietary stainless steel bitumen membrane rain water outlet, 110 mm, 400mm.

Reference manufacturer: Jual.

**ROF-035 – CABLE PENETRATION UNITS**

Install two-part service penetration Swan Necks by BigFoot Systems. Light aluminium mechanically fixed base and removable hood. Outlet type and size to suit electrical layout

requirements. All roof plinths, parapets, thresholds, upstands, installations and services penetrations to be waterproofed following roof system manufacturer's instructions.

## 2.1 ROOF PERFORMANCE

General: Secure, free draining and weathertight. Airtight. Continuity of insulation and avoidance of thermal bridging. Vapour controlled.

### 2.1.1 AVOIDANCE OF INTERSTITIAL CONDENSATION: WARM AND INVERTED ROOFS

Determine: Interstitial condensation risk of roof construction as recommended in BS 5250, annex D.

Vapour control layer: If necessary, provide a suitable membrane so that damage and nuisance from interstitial condensation do not occur.

### 2.1.2 INSULATION

Requirement: Determine type and thickness of insulation and integral or separate overlay to satisfy the following criteria:

- Thermal transmittance of roof (minimum): 0.16 W/m<sup>2</sup>K.
- Where roofs are designed with Tapering Insulation to field or gutter zones, insulation thickness shall be designed to ensure compliance with U Value requirements in accordance with Part L of the Building Regulations throughout the project.
- Compressive strength of insulation (minimum) at 10% compression: 150KpA.
- Finished surface: Suitably even, stable and robust to receive roof covering.
- Insulation compliance: Certified component of Roof Waterproofing System.

The design roof insulation design shall incorporate drainage crickets to minimise thermal bridging at corners, to ensure free flow of drainage waters and to prevent ponding. The dimensions of the tapered cricket shall be approved by the Project Architect.

### 2.1.3 ATTACHMENT OF ROOF COVERING

Requirement: Determine methods of attachment to resist wind loads. Provide for relative movement of materials and effects of vapour pressure. Do not reduce performance of vapour control layer.

Wind loads: wind uplift resistance calculation to Irish National Standard ISEN14/NA2010 utilising National Determined Parameters, provided by the Roof Waterproofing System Supplier.

### 2.1.4 BITUMINOUS PRIMER

Where applicable, Bituminous Priming Solution to meet characteristics of BS 8217, clause 5.6.2., supplied by approved installer, or Bitumen cut back with volatile solvent application and as approved in writing by the modified bitumen membrane manufacturer. Characteristics when tested to EN 13357:

- Volatile solvent content (minimum): 40% by mass.
- Viscosity (maximum) (STV at 25°C, 4 mm orifice): 10s.

### 2.1.5 FASTENERS AND PLATES

Provide coated, corrosion resistant thermally isolated fasteners as recommended by the roof system manufacturer's printed instructions and meeting the requirements of FM 4470 and FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified.

### 2.1.6 MASONRY OR CONCRETE WALLS AND VERTICAL SURFACES

Use hardened steel nails or screws with flat heads, diamond shaped points, and mechanically deformed shanks not less than 25.0 mm long for securing roofing sheets, metal items, and accessories to masonry or concrete walls and vertical surfaces. Use power driven fasteners only when approved in writing by the Contracting Officer.

### 2.1.7 PRE-MANUFACTURED ACCESSORIES

Pre manufactured accessories must be manufacturer's standard for intended purpose, compatible with the membrane roof system and approved for use by the modified bitumen membrane manufacturer.

## 2.2 CONFORMANCE WITH APPLICABLE TECHNICAL STANDARDS

- A. Decks to which the membranes are to be applied must comply with the relevant requirements of BS 6229:2003, BS 8217:2005.
- B. BS 8000-4:1989 Workmanship on building sites — Code of practice for waterproofing

- C. EN 1991-1-4 : 2005 + A1 : 2010 Eurocode 1 : Actions on structures — General actions — Wind actions. NA to EN 1991-1-4 : 2005 + A1 : 2010 UK National Annex to Eurocode 1 : Actions on structures — General actions — Wind actions
- D. EN 13956 : 2012 Flexible sheet for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics
- E. EN 13707:2004 & A2:2009 Flexible Sheets for Waterproofing – Reinforced Bitumen Sheets for Roof Waterproofing.
- F. BS 8217 : 2005 Reinforced bitumen membranes for roofing — Code of practice
- G. ASTM D6164 – Standard Specification for SBS Modified Bituminous Sheet Materials using polyester reinforcements: 2011.
- H. CE & DoP Declaration in Accordance with European Construction Products Directive.
- I. Product Orthometrics – Declared in accordance with UNI8202 and UEAtc Directives.
- J. EPD Certification Environmental Declaration – BWA Association EPD Certificate CPC Code 5453 – Roofing & Waterproofing Services.
- K. EN ISO 9001:2008 Quality management systems — Requirements
- L. EN ISO 14001:2004 Environmental management systems — Requirements with guidance for use

### 2.3 BASIS OF DESIGN PRODUCT / MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:  
Waterproof covering: Roof System manufacturer's Technicians will carry out regular inspections of the project during the course of the works. The Approved Contractor must give reasonable notice to Roof System manufacturer of their intention to commence laying each layer of waterproofing system. This will allow a compulsory inspection of each layer of waterproofing system take place, so that any remedial treatment necessary prior to installing the following layer. This is particularly important to ensure that any areas of standing water that may remain can be addressed.  
The Roof System manufacturer must be notified when the roof is ready for the final inspection and all related works and snagging complete.

### 2.4 INSPECTION BY MATERIAL MANUFACTURER'S REPRESENTATIVE

Manufacturer's technical representative must visit the site a minimum of three times per week during the installation for purposes of reviewing materials installation practices and adequacy of work in place.  
Inspections must occur during the first 20 square metres of membrane installation, at midpoint of the installation, and at practical completion of the roofing installation, at a minimum.  
Additional inspections must not exceed one for each 100 metre square of total roof area with the exception that follow up inspections of previously noted deficiencies or application errors must be performed as requested by the Contractor.  
After each inspection, submit a report, signed by the manufacturer's technical representative to the Contractor and Client's Representative within 3 working days.  
Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

### 2.5 QC CONTROLS DURING INSTALLATION (INSTALLERS CONTROLS)

- All works to be completed in accordance with Manufacturers Installation Guidelines.  
Application shall be carried out by skilled and badged operatives only.  
Substrates shall be clean and dry.  
Do not apply during high winds or in wet and damp conditions.  
Membranes shall be installed up the slope.  
Offset intermediate and cap layers.  
Fully bond membrane to substrates.  
Completed coverings shall be fully bonded, firmly attached, smooth, weatherproof and free draining.  
All stages of the work shall be documented in Daily working diary, to include representative

### 2.6 QC CONTROLS DURING INSTALLATION

Roof waterproofing system manufacturer's appointed site Technical Representative shall have Industry Experience and Manufacturers Installation Training in all elements of the roof assembly.  
System manufacturer shall attend a pre contract start up meeting with Applicator, Main contractor, Architect and Client's Representatives.

System manufacturer shall deliver a prestart tool box talk to the badged operatives and other operatives of the Applicator.

System manufacturer shall conduct site visits during the period of installation, in accordance with the preliminary inspection plan (PIP) intervals, reporting on observations to the Applicator, Main contractor, Architect and Client's Representatives.

## 2.7 QC CONTROLS UPON COMPLETION

Conduct detailed visual inspection on completed roof zones.

Conduct Thermographic Imaging Survey of completed zones by Licensed Thermographer with Roof Survey Experience and Expertise, reporting on same to Applicator, Main contractor, Architect and Client's Representatives.

Install protection, as approved by the Project Architect on completed roof surfaces.

Roof protection shall remain in situ until all roof works and including M&E works are completed.

Access to completed roof zones to be allowed by means of permit only.

No cutting, grinding, welding, drilling or other activities likely to cause damage to completed waterproofing membranes are to be allowed on completed roof surfaces.

## 2.8 DESIGN RESPONSIBILITY

Designers & Inspectors Technical Qualifications.

Design Inspectors will hold NFQ level 7 Engineering qualification and/or NFQ level 8 Honours Degree qualifications. Design and Installation Inspectors will have manufacturers training in all elements of the design and installation techniques of the roof assembly as defined by the roof waterproofing system manufacturer. Design and Installation Inspectors will have a minimum of 10 years roof waterproofing industry experience, across a range of project types and of all scales within the UK construction industry. Senior Inspectors will have 20 years + experience within the Industry.

The roof waterproofing system manufacturer shall prepare a full set of roof assembly design details. All details will be presented to the Project Architect in CAD & PDF format for approval.

The roof waterproofing system manufacturer shall hold appropriate PI Insurance.

## 2.9 ELECTRONIC TESTING OF ROOF INTEGRITY

Detection of Thermal Anomaly caused by water ingress due to damaged membrane:

Thermographic Inspectors shall hold NFQ level 7 Engineering qualification and/or NFQ level 8 Honours Degree qualifications. Inspectors shall hold ITC Thermographers License. Inspectors shall have manufacturers training in thermographic survey techniques and 10 years (minimum) Thermographic Roof Survey Experience.

Survey Technique: Completed roof areas shall be subject to thermographic survey using FLIR P65 ThermaCAM, upon completion each area shall be described in a written report and all anomalies shall be identified and investigated.

## 2.10 WARRANTY

Roof System Warranty: Upon completion of works, the roof waterproofing system manufacturer shall issue a 20 years, back to back, materials & workmanship, roof system warranty.

Roof Maintenance Workshop.

Upon completion of works, the roof waterproofing system manufacturer shall host a roof maintenance workshop with the building management team and the client representative. This workshop will empower the building maintenance team to conduct annual maintenance and outline best practice in the maintenance and management of Data Hall Roofs.

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**PART 3 – EXECUTION****3.0 WORKMANSHIP**

- A. Unless specified otherwise, the installation of the works shall be carried out by roof system manufacturer approved and trained, competent installers using methods in strict accordance with the various manufacturers' written recommendations and the relevant standards to provide a secure, free draining and completely weathertight, waterproof roof.
- B. Any ancillary products or accessories, where not specified, shall be types recommended for the purpose.
- C. The manufacturer's printed instructions and installation details shall be strictly adhered to including, but not limited to the following:
  - 1. Roof coverings shall be laid in a single operation to provide a secure, free draining, weathertight roof.
  - 2. Daywork joints in warm deck roofs shall be protected with a lapped and fully bonded strip of top layer felt.
  - 3. Heat bonding compound and lay at temperature sufficient to ensure bonding over the whole surface. Do not overheat.
  - 4. Torched on sheets shall be applied using equipment and method recommended by the roof system manufacturer. Ensure that there is a full bond over the surface, with no air pockets.
  - 5. All details shall be formed with adequate overlapping, staggering of laps and full bonding of successive layers so that they are waterproof. Strips of felt required for 'linear' details shall be cut from the length of the roll rather than the width.

**3.1 EXAMINATION**

Ensure that the following conditions exist prior to application of the roofing materials:

- 1. Drains, curbs, cants, control joints, expansion joints, perimeter walls, roof penetrating components, and equipment supports are in place.
- 2. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.
- 3. The plane of the substrate does not vary more than 6.00 mm within an area 3.0 by 3.0 metres when checked with a 3.0 metre straight edge placed anywhere on the substrate.
- 4. Substrate insulation is sloped to a fall of 1:60 as indicated to provide positive drainage.
- 5. Walls and vertical surfaces are constructed to receive counter flashing, and will permit mechanical fastening of the base flashing materials.
- 6. Protect all combustible materials and surfaces which may contain concealed combustible or flammable materials. All fire extinguishing equipment has been placed as specified.
- 7. Verify all Fire Watch personnel assignments.
- 8. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the length of the vertical leg is not less than 100 mm.

**3.2 PROTECTIVE COVERINGS**

Install protective coverings prior to starting the work. Lap protective coverings not less than 150 mm, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

**3.3 MECHANICAL APPLICATION DEVICES**

Mount mechanical application devices on pneumatic tyred wheels. Use devices designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

**3.4 FLAMEHEATED EQUIPMENT**

Do not place flame heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame heated equipment and on the roof.

**3.5 OPEN FLAME APPLICATION EQUIPMENT**

Torches and other open flame equipment must be specifically designated for its intended use and approved by the modified bitumen sheet manufacturer. Open flame equipment must not be ignited (burning) when left unattended. Provide and maintain a fire extinguisher adjacent to open flame equipment on the roof. Specific requirements for fire watches and burn permits exist. These requirements will be reviewed at the pre-roofing conference.

### 3.6 PRIMING OF SURFACES

Prime all surfaces to be in contact with adhered membrane materials. Apply primer at the rate recommended by the sheet manufacturer's printed instructions to promote adhesion of membrane materials. Allow primer to dry prior to application of membrane materials to primed surface. Avoid flammable primer material conditions in torch applied membrane applications.

### 3.7 PRIMING OF CONCRETE AND MASONRY SURFACES

After surface dryness requirements have been met, coat concrete and masonry surfaces which are to receive applied membrane materials uniformly with primer.

### 3.8 PRIMING OF METAL SURFACES

Prime flanges of metal components to be embedded into the roof system prior to setting in bituminous materials or stripping into roofing system.

### 3.9 SUBSTRATE PREPARATION

Apply membrane to clean, dry surfaces only. Do not apply membrane to surfaces that have been wet by rain or frozen precipitation within the previous 12 hours. Provide cleaning and artificial drying following manufacturer's recommendations as necessary to ensure clean, dry surface prior to membrane application.

### 3.10 APPLICATION

Apply roofing materials as specified herein unless approved otherwise by the Client's Representative. Keep roofing materials dry before and during application. Complete application of roofing in a continuous operation.

Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Provide temporary roofing and flashing as specified herein prior to application of permanent roofing system.

### 3.11 PHASED MEMBRANE CONSTRUCTION

Phased application of membrane plies is prohibited unless otherwise approved by the Contracting Officer and supported by the membrane manufacturer's written application instructions. If cap sheet installation is delayed, thoroughly clean the applied membrane material surface and dry immediately prior to cap sheet installation. Priming of the applied membrane surface may be required at the discretion of the Contracting Officer prior to cap sheet installation.

### 3.12 TEMPORARY ROOFING AND FLASHING

Provide watertight temporary roofing and flashing where considerable work by other trades, is to be performed on the roof or where construction scheduling or weather conditions require protection of the building's interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

Completely remove temporary roofing and flashing before continuing with application of the permanent roofing system.

### 3.13 MODIFIED BITUMEN MEMBRANE SYSTEMS

#### 3.13.1 PREPARATION

Unroll modified bitumen membrane materials and allow to relax a minimum of 30 minutes prior to installation. In cold weather, adhere to membrane manufacturer's additional recommendations for pre-installation membrane handling and preparation. Inspect for damage, pinholes, and particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Edges of seams must be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles. Discard damaged or defective materials.

#### 3.13.2 TORCH APPLIED HEAT WELDED MODIFIED BITUMEN MEMBRANE

Ensure substrate membrane surfaces are warmed either naturally or by torch during the installation.

Apply heat evenly to underside of roll membrane being installed and exposed side lap area of previously installed sheet.

Provide for slight, uniform flow of bitumen in front of roll and full width of roll as the material is being rolled or set into place. Apply uniform positive pressure to ensure membrane is fully adhered and all laps are sealed. Prior to forming lap over granulated surfaces, embed granules

of the receiving sheet by heating and trowelling in the granules to form a uniform black compound surface.

Roll all lap areas with a weighted roller immediately after forming lap.

Provide for visual bleed out of compound in lap areas.

Avoid overheating the membrane or burning through to membrane reinforcement.

Inspect and ensure all lap areas are fully sealed.

### 3.13.3 MODIFIED BITUMEN BASE SHEET

Fully adhere / spot adhere base sheets in accordance with membrane manufacturer's printed instructions.

Extend base sheets approximately 150 mm above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere.

Trim base sheet to a neat fit around vent pipes, roof drains, and other projections through the roof. Application must be free of ridges, wrinkles, and buckles.

### 3.13.4 MODIFIED BITUMEN MEMBRANE APPLICATION

Ensure proper sheet alignment prior to installation. Apply membrane layers perpendicular to slope of roof in shingle fashion to shed water, including application on areas of tapered substrate that change slope direction.

Bucking or backwater laps are prohibited. Fully adhere membrane sheets to underlying substrate materials. Provide minimum 100 mm side laps and minimum 150 mm end laps and as otherwise required by membrane manufacturer.

Stagger end laps minimum 900 mm. Offset side laps between membrane layers a minimum of 300 mm. Offset end laps between membrane layers a minimum of 900 mm. Install all membrane layers the same workday, unless supported otherwise by roof membrane manufacturer application instructions and approved by the Contracting Officer. Provide tight smooth laminations of each membrane layer without wrinkles, ridges, buckles, kinks, fish mouths, or voids.

Ensure full membrane adhesion and full lap seals. Rework to seal any open laps prior to application of subsequent membrane layers. The completed membrane application must be free of surface abrasions, air pockets, blisters, ridges, wrinkles, buckles, kinks, fish mouths, voids, or open seams.

### 3.13.5 CAP SHEET INSTALLATION

Underlying applied membrane must be inspected and repaired free of damage, holes, puncture, gouges, abrasions, and any other defects, and free of moisture, loose materials, debris, sediments, dust, and any other conditions required by the membrane manufacturer prior to cap sheet installation. Do not apply cap sheet if rain or frozen precipitation has occurred within the previous 24 hours. Align cap membrane and apply by the specified method with the proper side and end lap widths.

Torch apply the cap sheet as recommended by the modified bitumen membrane manufacturer. Cut at a 45 degree angle across selvage edge of cap membrane to be overlapped in end lap areas prior to applying overlapping cap membrane. Apply matching granules in any areas of adhesive bleed out while the adhesive is still tacky. Minimize traffic on newly installed cap sheet membrane.

### 3.13.6 MEMBRANE FLASHING

Apply two ply modified bitumen strip flashing and sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, and where necessary to make the work watertight. Apply membrane flashing in accordance with the roof membrane manufacturers printed instructions and as specified.

Cut at a 45 degree angle across terminating end lap area of cap membrane prior to applying adjacent overlapping cap membrane. Press flashing into place to ensure full adhesion and avoid bridging. Ensure full lap seal in all lap areas.

Mechanically fasten top edge of modified bituminous base flashing 150 mm on centre through minimum 25.00 mm diameter tin caps with fasteners of sufficient length to embed minimum one inch into attachment substrate.

Apply matching granules in any areas of adhesive bleed out while the adhesive is still tacky.

Apply membrane liner to top edge of base flashing installation at curbs, parapet walls, and expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components.

Do not set metal flashing in hot asphalt.

**3.13.7 MEMBRANE STRIP FLASHING**

Install flanges of metal flashing in full bed of modified bituminous cement material and securely fasten through to attachment substrate.

Striping with membrane flashing so that strip extends not less than 100 mm beyond outer edge of flange. Where multiple membrane stripping plies are installed, extend each additional stripping ply minimum 100 mm beyond edge of previous ply.

**3.13.8 MEMBRANE FLASHING AT ROOF DRAIN**

Roof drains are specified in Section 22 14 00 (Rainwater Drainage).

Extend membrane sheets to edge of drain bowl opening at the roof drain deck flange in accordance with membrane and drain manufacturers' printed application instructions. Securely clamp membrane sheets and metal roof drain flashing and strip flashing in the flashing clamping ring. Secure clamps so that sheets and metal flashing are free from wrinkles and folds.

Trim stripping must be flush with inside of clamping ring.

**3.13.9 SAMPLES OF ROOFING - MODIFIED BITUMEN MEMBRANE**

Where required by the Architect, take samples per ASTM D5147/D5147M, sized 100 mm by 1000 mm cut across width of modified bitumen sheets as directed by the Contracting Officer. Cut samples will be examined by the Contracting Officer for specified number of plies, proper lap width, complete lap seal, full uniform adhesive compound application and adhesion, full bond between plies, harmful foreign materials, presence of moisture, and wet insulation.

Where cuts are not retained by the Contracting Officer or disposed, set cut strip back in cut area in bed of modified bitumen cement. Repair area of cut with new minimum two ply modified bitumen membrane patch.

**3.14 PREFABRICATED CURBS**

Securely anchor prefabricated curbs to nailer or other base substrate and flash with modified bitumen membrane.

**3.15 SET ON ACCESSORIES**

Where pipe or conduit blocking, supports and similar roof accessories are set on the membrane, adhere walk pad material to bottom of accessories prior to setting on roofing membrane.

Specific method of installing set on accessories must permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set on accessories through roofing membrane into roof deck substrate.

**3.16 LIGHTNING PROTECTION**

Flash and attach lightning protection system components to the roof membrane in a manner acceptable to the roof membrane manufacturer. Refer to the M&E Consultants for details on the Lightning Protection strategy for the roofs.

Lightning Protection Anchors shall be compatible fixing to secure lightning conductor tape to a flat roof membrane. The design will allow high levels of movement without exerting stress on the bond to the roof.

Lightning Protection Anchors shall be purpose-made clips mechanically fixed to waterproofing pads.

The Lightning Protection Anchors shall be fully bonded to the roof surface to provide a robust and durable fixing of the lightning conductor tape, in accordance with the manufacturer's instructions.

**3.17 ROOF WALKPADS**

Install walk pads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the sheet roofing manufacturer's printed instructions.

Provide minimum 150 mm separation between adjacent walk pads to accommodate drainage. Provide walk pad or an additional layer of cap sheet under precast concrete paver blocks to protect the roofing.

**3.18 DAILY CLEAN UP**

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

**3.19 PROTECTION OF APPLIED ROOFING**

At the end of the day's work and when precipitation is imminent, protect all areas of applied modified bitumen roofing system or any other vulnerable material or product from water intrusion.

**3.20 TEMPORARY FLASHING FOR PERMANENT ROOFING**

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashing can be applied.  
Remove temporary flashing before applying permanent flashing.

**3.21 TEMPORARY WALKWAYS, RUNWAYS, AND PLATFORMS**

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber tyred equipment for roofing work.

**3.22 FIELD QUALITY CONTROL**

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

**3.23 TEST FOR SURFACE DRYNESS**

Before application of membrane sheets and starting work on the area to be roofed, perform test for surface dryness in accordance with the following:

Prior to installing any roof system on a concrete deck, conduct a test per ASTM D4263. The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

**3.24 CONSTRUCTION MONITORING**

During progress of the roof work, Contractor must make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

- A. Materials comply with the specified requirements.
- B. Materials are not installed in adverse weather conditions.
  - All materials are properly stored, handled and protected from moisture or other damages.
- C. Equipment is in working order. Metering devices are accurate.
- D. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.
  - 1 Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.
  - 2 The proper number, type, and spacing of fasteners / fixings are installed.  
Membrane heating, hot mopping, or adhesive application is provided uniformly and as necessary to ensure full adhesion of roll materials. Asphalt is heated and applied within the specified temperature range.  
The proper number and types of plies are installed, with the specified overlaps.  
Applied membrane surface is inspected, cleaned, dry, and repaired as necessary prior to cap sheet installation.
  - 3 Lap areas of all plies are completely sealed.  
Membrane is fully adhered without ridges, wrinkles, kinks, fish mouths, or other voids or delaminations.  
Installer adheres to specified and detailed application parameters. Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.  
Temporary protection measures are in place at the end of each work shift.

**3.25 MANUFACTURER'S INSPECTION**

The Manufacturer's technical representative must visit the site a minimum of three times per week during the installation for purposes of reviewing materials installation practices and adequacy of work in place.

Inspections must occur during the first 20 square metres of membrane installation, at midpoint of the installation, and at practical completion, at a minimum. Additional inspections must not exceed one for each 100 metre square of total roof area with the exception that follow up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer.

After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

### 3.26 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, additional measures will be taken as deemed necessary by the Contracting Officer to determine the extent of the deficiency and corrective actions must be performed as directed by the Contracting Officer.

### 3.27 ROOF TESTING

#### 3.27.1 MANDATORY ROOF TESTS TO BE UNDERTAKEN

- A. Test the water tightness of the roof using the following to the acceptance of the Architect and / or Client's Representative.
- B. Regular visual inspections and detailed reporting.
- C. Thermographic test.
- D. Spark / electronic integrity testing.
- E. Downpipe / rainwater outlet test.
- F. Hose test.
- G. Simulated Rain test.
- H. Flood test.
- I. Air Infiltration test.
- J. Details of the testing system(s) and proposed method statement(s) shall be submitted for acceptance at least one month prior to the proposed testing on Site.
- K. Prior to testing, ensure that the works have been completed to a stage where the integrity of the membrane can be tested, that obvious defects have been made good and that the roof has been cleared of all materials, debris, dust, etc.
- L. Testing shall be carried out when all works to the roof areas are complete, including that of all associated and interfacing trades.

#### 3.27.2 INFRARED INSPECTION: ELECTRONIC THERMOGRAPHIC ROOF INTEGRITY TEST

Testing authority: Waterproofing System Manufacturer, to be conducted by independent, NSAI / SEAI / UKAS licensed Thermographer.

Timing of test: Upon completion of roof waterproofing.

Site Conditions at the time of the test: 12 hours without direct solar radiation on the building prior to test, no solar radiation on the building during the test and a maximum variation of 5°C in the outdoor air temperature during the period of the investigation.

The thermographer is to make a recording of air pressures at each storey of the building, the amount of solar radiation during the 12 hours before the test and the air temperatures over the 24 hours preceding the test.

Condition of roof prior to testing: Complete to a stage where integrity can be tested.

Surface: Clean and dry.

Provide upon completion, a thermographic report on all roof areas showing corresponding photographic and thermographic images.

#### 3.27.3 ELECTRONIC ROOF INTEGRITY TEST

- A. Electrical conductance leak detection test to be carried out by an NSAI / INAB approved independent authority.
- B. Carry out test prior to laying of cap sheet and after final installation of the cap sheet.
- C. Prior to testing ensure that roofing work has been completed to a stage where the integrity of the membrane can be tested, that obvious defects have been made good and that the roof has been cleared of all materials, debris, dust, etc.
- D. If any leaks / defects are discovered mark the location on the roof, prepare report and submit to Architect together with proposals for remedial measures.
- E. After making good of any defects by the Contractor retest locally to verify integrity of repair.
- F. On completion certify the waterproof integrity of the roof.
- G. Roof system manufacturer to conduct a NSAI / INAB approved electronic integrity test, to completed roof areas (prior to installation of paving). Written report to be issued to Architect, incorporating photographic record.

#### 3.27.4 DOWNPIPE / RAINWATER OUTLET TESTING TO BE UNDERTAKEN

- A. Testing regime to be undertaken post installation shall include:
- B. Pressure test to 4.5 Bar pressure.
- C. CCTV survey of rainwater pipe installation.

#### 3.27.5 SIMULATED RAIN TEST

- A. Rain Test: Subject the designated area of roof to a 15 minute rain test using a spray rack containing sufficient hose nozzles to deliver the acceptable equivalent of 75mm of rain per hour.

- B. Check for leaks using endoscopy or other non-destructive methods, or by opening up the construction as directed.
- C. Perform repairs or replacements as necessary.
- D. Perform additional tests and inspections as directed.

#### 3.27.6 FLOOD TEST

- A. On completion of the waterproofing membrane and prior to the installation of any elements of the roof system above the waterproofing membrane, it shall be tested using the flood testing method as described. The Contractor shall prepare a method statement and drawing(s) describing the test areas, methods and sequence of testing.
- B. The Contractor shall allow for Testing to be performed on all flat roofs. The test shall be carried out on areas not exceeding 200 m<sup>2</sup>. These areas shall be filled to a depth of 100mm and shall be left for 36 hours. Adjacent areas and areas below the test area shall be continually inspected for leaks.
- C. The depth of the water shall be monitored during the 36 hour test period. Any leaks or loss of water depth shall be reported immediately to the Design Team.
- D. As soon as possible after any part of the work is known to be (or suspected of being) defective, the Contractor shall submit proposals to the Design Team for further testing, opening up, inspection, making good and retesting. Wherever this shows that the work is not in accordance with the Contract Specification, measures shall be taken to establish the acceptability of the work.
- E. The Contractor shall:
  - 1. Check that the test (and any defects revealed) throughout the necessary period will not interfere with programmed works or, in the case of a building in occupation, with the occupation.
  - 2. Confirm with the Structural Engineer that the superimposed load of the test is structurally acceptable.
  - 3. Ensure that the intended flood level does not come above kerbs, flashing, etc.
  - 4. Prior to flooding, check that all relevant work is complete and inspect for damage.
  - 5. Remedy any damage as necessary.
  - 6. Externally cover and seal all outlets and protects from water pressure.
  - 7. Flood for 48 hours to an agreed level and continually inspect for leaks.
  - 8. Drain slowly: it is unlikely that all bends and couplings will be sufficiently braced for unrestricted flow under the head created by the test.
  - 9. Carry out any necessary remedial work and retest, incorporating a dye (if necessary) to distinguish from entrapped water from a previous test.
  - 10. Where leaks have occurred, submit detailed proposals for remedial measures. After acceptance and completion of proposed works the flood test is to be reinstated. Only when a flood tested roof area has shown no leakage for a period of seven days will further work on that part of the roof be permitted.
  - 11. Any area that cannot be flood tested shall be pressure hose tested.

Due to the sensitivity of building's internal installations, the extent and timing of roof drain tests must be agreed with Architect and Client Representative.

#### 3.27.7 PERFORMANCE UNDER TESTING

- A. There shall be no leakage through the works at any time during testing.
- B. If leaks occur the water shall be drained completely and the membrane installation repaired and retested. Any part of the works that is adversely affected shall be replaced or repaired.
- C. At completion of the test there shall be no standing water in locations intended to remain dry. Certify the waterproof integrity of the roof.
- D. All tests are to be witnessed by the Client's Representative.

#### 3.27.8 AIR INFILTRATION TEST

- A. An air infiltration test shall be carried out to all roof areas in accordance with the procedure for testing as specified in IS EN 13829: 2000 'Thermal performance of buildings: determination of air permeability of buildings: fan pressurisation method'. Additional guidance on testing procedure is given in CIBSE Technical Manual TM 23 'Testing Buildings for Air leakage' and BRE document BR 448 Tightness in Commercial and Public Buildings, appended to the Preliminaries section of the tender documents, and the costs for this test shall be deemed to be included in the contract price. Air pressure to be achieved is 5.0 m<sup>3</sup>/h/m<sup>2</sup> @ 50Pa.

#### 3.27.9 TEST REPORTING

- A. Site testing reports shall be prepared and submitted to the Design Team who shall identify where clarification and additional work is necessary.
- B. The reports shall contain the information listed under the following headings:
  - 1. Date of test, and of report.

2. Identification of the areas tested.
3. The duration of the test with a statement of how water was applied, where the test started, how it was progressed and where it finished.
4. A statement that the test carried out was in accordance with the standards referred to in this document, or a full description of any deviation from the standards previously agreed by the Design Team.
5. A statement that the test was successful, or alternatively, a note of any leakages through and/or directly below the area being tested, together with an indication of the severity of leakage.
6. Name and author of report.
7. Name and address of Testing Authority that conducted tests, and the requester of the tests.
8. Signature of person responsible for supervision of tests and list of official observers.

### 3.28 ROOF SYSTEM MANUFACTURER'S MAINTENANCE INSTRUCTIONS TO CONTRACTOR'S PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Construction and Client's personnel. Furnish instructions by a competent representative of the system manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane.

Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

### 3.29 BUILDING OPERATIONS AND MAINTENANCE MANUAL (BOM)

- A. One month before programmed completion of the works/ Practical Completion prepare and submit, to the satisfaction of the Architect, three paper copies of a Buildings Operations and Maintenance Manual and an electronic copy, required to maintain the works.
- B. CONTENT:  
The Building and Operations Maintenance Manual shall incorporate all maintenance systems and give details of the operation and required maintenance of all items, components and systems comprising the works.  
Cleaning procedures for all elements of the works.  
Replacement procedures.  
Regular cyclical maintenance procedures (avoiding damage).  
Repair procedures in the event of damage.  
Details shall be provided in respect of the maximum time during which performance of components can be maintained, together with the frequency and method of washing required to achieve this.
- C. COMPONENT INFORMATION:  
The following information shall be supplied for every item, component and/or system:  
Certified manufacturing certificate.  
Full description giving any special features. A full breakdown of the parts and the catalogue number of the constituent parts.  
The guarantee period of any element or material where in excess of the warranty required by the Specification.

### 3.30 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

- A. Set of 'As Built' drawings and material certification.
- B. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the metal floor grating installation, including all accessories.
- C. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
- D. Product Technical Data Sheets.
- E. Installation Method Statement(s) and any agreed revisions.
- F. Certified copies of each report prepared by the manufacturer's representative(s).
- G. Warranties: Refer to Clause No. 1.19.
- H. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.

- I. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

### 3.31 INFORMATION CARD

For each roof, furnish a typewritten information card for facility Records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm thick aluminium card for exterior display. Card must be 215 mm by 275 mm minimum.

Information card must identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation type and thickness, cover board system and thickness; presence of flat / tapered insulation for primary drainage, presence of vapour retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information.

The card must be a minimum size of 215 mm by 275 mm. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

### 3.32 CLEANING

- A. Clean roof area of all packaging materials and excess materials. Sweep roof area upon completion of work, removing all debris associated with roofing installation.
- B. Remove all loose materials, crating and packing materials from the site of installation.

### 3.33 WASTE MANAGEMENT

Coordinate with manufacturer for take-back programme. Set aside packaging and scrap, including damaged and over ordered product to be returned to manufacturer for recycling into new product.

**END OF SECTION 07 50 00**

**SECTION 08 11 13 – METAL DOORS AND FRAMES****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

To be read with the Contract, Drawings and other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

A. This section describes the installation of metal doors and frames (doorsets) for external use. This specification is to be read in conjunction with the Design Intent Drawings and specification Section 08 44 13 (Glazed Aluminium Curtain Walls) prepared for the project. External metal doorsets shall be integrated into the façade of the building, to match the external finishes and shall be included in the scope of work for the SFS.

This Section includes non-rated and fire-rated metal work door sets.

B. The Contractor shall design test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation to the Employer's Representative's approval. To include all items necessary for full completion and finishing of the work not necessarily included.

**1.3 RELATED WORK**

07 42 16 – Insulated Core metal Panels

07 84 00 – Firestopping

07 92 00 – Sealants

08 14 00 – Wood Doors

08 44 13 – Glazed Aluminium Curtain Walls

08 71 00 – Door Hardware

Building Management System: For all locking and Master key requirements for the Project.

**1.3.1 COMPONENT OR ELEMENT TYPES**

EDR-001 – EXTERNAL GRADE STEEL SECURITY DOORSETS

EDR-002 – EXTERNAL GRADE GALVANISED STEEL DOORSETS

EDR-003 – TEMPORARY EXTERNAL GRADE STEEL SECURITY DOORSETS (FIRE-RATED)

IDR-001 – INTERNAL GRADE METAL DOORSET

FRA-001 – METAL FRAMES TO INTERNAL DOORS

FRA-002 – THERMALLY BROKEN METAL FRAMES TO EXTERNAL SERVICE HATCHES

**1.3.2 DEFINITIONS**

A. Where the word 'Design' occurs in this document it will be described as 'Design\*'. The Asterisk implies that 'Under the design portion requirements of this specification the Contractor is requested to take the design intent and apply their own manufacturers systems and materials performance data to comply with all criteria set out in this specification document and the design intent drawings'.

B. CE Marked doorsets must be complete as follows:

The doorsets shall comprise of factory prepared door leaf or leaves, and frame(s), including any side panel(s), vision panel(s), flush over panel(s), transom panel(s) and/or glazing together with any seals and ironmongery/ hardware essential for performance of the function for which the doorset is intended and CE Marked, which may vary therefore from doorset type to doorset type.

The doorsets must have a single source.

The doorsets shall be provided by one legal entity who takes all responsibility for the testing, certification and performance of the doorsets and the application of the all applicable CE Mark(s) which may affect all or any components of the Doorset.

The doorsets must be supplied fully assembled to include but not be limited to the following, all finishing, framing, seals, gaskets, ironmongery/hardware.

**1.3.3 IRONMONGERY SETTING**

It is a requirement that allowance is made to deliver the ironmongery to the Door Manufacturers, by the ironmongery/ hardware supplier, in Door Specific, individual fully coordinated sets, comprising all of the ironmongery required to be fitted to each doorset.

The Ironmongery / hardware sets shall be organised on a doorset by doorset basis, and arrive in 'door specific' individual transparent blister packs, each bearing a clearly annotated reference code which coordinates fully with the project Door Schedule.

All items shall be provided with clear fixing instructions contained within each blister pack and all morticed items and door closing devices shall be supplied with fixing templates.

All items of door ironmongery shall be supplied complete with stainless steel screws to the type and length recommended in writing by the manufacturer and suitable for fixing to wood or metal as appropriate to suit the door leaf and frame.

All ironmongery shall be factory fitted by the Door Manufacturer.

#### 1.4 SUMMARY

A. The work shall include, but is not necessarily limited to the following:

- 1 Steel doors (fully finished upon delivery to site) as per drawings including ESB approved door to substation.
- 2 All doors to be factory finished in Employer's Representative and Client approved selected colour(s).
- 3 Louvre assemblies incorporating insect mesh in doors and weathering cowls to doors with service opes to electrical services as shown. Mesh type (openness 67-69%) to be agreed with the Mechanical Engineer.
- 4 Ironmongery.
- 5 Seals.
- 6 Insulation.
- 7 Fire/smoke assemblies.
- 8 Wind Restrictors
- 9 Fixing plates, brackets, angles and attachments.
- 10 Drilling of structural (components) and concrete.
- 11 Finishes to all exposed or internal surfaces.
- 12 Mock-ups.
- 13 Samples.
- 14 Tests.
- 15 Trimming to internal finishes.
- 16 Flashing and seals exterior and interior, trims.
- 17 Builders work in connection with the system.
- 18 Secondary structural supports required to support the system.
- 19 All items not necessarily shown on the drawings required for the proper completion of the Subcontract works. Refer to Clause 'Scope of Work' in Section 01 10 00 (General Summary of Requirements) of this specification.
- 20 Temporary cylinders (Contractor Cores) to be provided – phased switch over to final cylinders pre-handover.
- 21 Compliance with specific security requirements.
- 22 Door protection to be provided to all internal and external exposed metal surfaces.
- 23 Section includes fire and non-fire-rated steel doors, with and without vision panels.

#### 1.5 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT

Building Regulations 2010

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

BRITISH STANDARDS INSTITUTION

EN 1125:2008 Building hardware. Panic exit devices operated by a horizontal bar, for use on escape routes. Requirements and test methods.

EN 1634-1:2000 Fire resistance tests for door and shutter assemblies. Fire doors and shutters.

EN 1634-1:2008 Fire resistance and smoke control tests for door, shutter and openable window assemblies and elements of building hardware. Fire resistance tests for doors, shutters and openable windows.

EN 1634-3:2004 Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies. + AMD 17090

EN 1935:2002 Building hardware. Single-axis hinges. Requirements and test methods. + AMD 15315

EN 1991-1-1:2002 Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings. + AMD 15507, Corrigendum February 2010

EN 13501-2:2007 Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services. + AMD November 2009

EN 14351-1:2006 Windows and doors. Product standard, performance characteristics. Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics. + AMD July 2010

BS 476-22:1987 Fire tests on building materials and structures. Methods for determination of the fire resistance of non-load-bearing elements of construction.

BS 476-31-1:1983 Fire tests on building materials and structures. Method for measuring smoke penetration through doorsets and shutter assemblies. Method of measurement under ambient temperature conditions. + AMD 8366.

BS 4800:2011 Schedule of paint colours for building purposes.

BS 5252:1976 Framework for colour co-ordination for building purposes. + AMD 5711

BS 5357:2007 Code of practice for installation and application of security glazing.

BS 6180:2011 Barriers in and about buildings. Code of practice.

BS 6206:1981 Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings. + AMD 4580, AMD 5189, AMD 7589, AMD 8693

BS 6213:2000 Selection of constructional sealants. Guide. + Amendment February 2010

BS 7036-1:1996 Code of practice for safety at powered doors for pedestrian use. General.

BS 8214:2008 Code of practice for fire door assemblies.

BS 8233:1999 Sound insulation and noise reduction for buildings. Code of practice.

BS 8300:2009 Design of buildings and their approaches to meet the needs of disabled people. Code of practice. + AMD July 2010

BS 9999:2008 Code of practice for fire safety in the design, management and use of buildings.

DD 171:1987 Guide to specifying performance requirements for hinged or pivoted doors (including test methods).

NA to EN 1991-1-1:2002:2005 UK National Annex to Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings.

DOOR AND HARDWARE FEDERATION  
Code of Practice 101-2 Code of practice for fire resisting metal doorsets. 2009

INTUMESCENT FIRE SEALS ASSOCIATION  
Information Sheet 3 Guide to the use of smoke seals in doorsets. 2010

EXOVA WARRINGTON FIRE RESEARCH CERTIFICATION  
Fire Installers Registration and Accreditation Scheme (FIRAS) Register of accredited installers and list of distributors of passive fire protection products. Register of approved products. 1994

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)  
Guide Choosing construction products: Guide to the recycled content of mainstream construction products.

## 1.6 ACTION SUBMITTALS

- A. Manufacturer's Technical Product Data: For each type of product.
1. Product Data: Confirmation that the products contain No Asbestos.
  2. Paints and Coatings: All products should be tested against EN ISO 11890-2:2006 Paints and varnishes. Determination of volatile organic compound (VOC) content. Gas-chromatographic method and meet the phase II maximum VOC content limit values set in Annex II of Decorative Paint Directive 2004/42/CE.  
The contractor is to include as part of the tender process, written evidence from product manufactures confirming the VOC content values of all products and that products have been tested against EN ISO 11890-2:2006.
  3. Include construction details, material descriptions, core descriptions, fire resistance ratings, and temperature-rise ratings, and finishes.
  4. Provide evidence of compliance with the requirements of Exova Warrington Fire Research 'Certifire' for all rated Fire Doors.
- B. SHOP DRAWINGS: Include the following:
1. Plans, sections, Elevations of each door type.
  2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of each different wall opening condition.
  6. Details of anchorages, joints, field splices, and connections.
  7. Details of accessories.
  8. Details of profiles, removable stops, wind restrictors and glazing.
  9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Initial Selection: For units with factory-applied colour finishes.

- D. Schedule: Provide a schedule of fire-rated metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Door numbering system to contain room numbering ref. on drawings. Co-ordinate with final Door Hardware Schedule.

#### 1.7 INFORMATION SUBMITTALS

- A. Product Test Reports: For each type of fire-rated metal door and frame assembly, for tests performed by the Exova Warrington Fire Research 'Certifire' qualified testing agency.
- B. Product Test Reports: For each type of fire-rated metal door and frame assembly, for tests performed by the qualified testing agencies.
- C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labelled assemblies.
- D. Provide evidence of compliance with the requirements of Exova Warrington Fire Research 'Certifire' Fire Doors.
- F. Acoustic laboratory test certificates demonstrating compliance with acoustic performance requirements.
- G. Documentation to be submitted at handover stage, as set out in Clause 3.4. A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).
- H. Documentation of manufacturer's take-back programme for damaged products, packaging etc. Include the following:
  - 1. Appropriate contact information.
  - 2. Overview of procedures.
  - 3. Identify manufacturer's policy for collection or return of remaining unused material and packaging material.
  - 4. Indicate manufacturer's commitment to recycle and/or reuse reclaimed materials and packaging.
  - 5. Limitations and conditions, if any, applicable to the project.

#### 1.8 METHOD STATEMENTS

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. All Doorsets and Fire Door Assemblies, shall be CE Marked, fully finished and complete with all ironmongery factory fitted and be individually shrink wrapped (in vented plastic), each bearing a clearly annotated reference code which coordinates fully with the project Door Schedule.
- B. Deliver fire-rated metal work palletized, packaged, or crated to provide protection during transit and Project-site storage.
- C. Provide additional protection to prevent damage to factory-finished units.
- D. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- E. Store fire-rated metal work vertically under cover at Project site with head up. Place on minimum 102-mm- high wood blocking. Provide minimum 6-mm space between each stacked door to permit air circulation.

#### 1.10 PROJECT CONDITIONS

- A. Field measurements: The Contractor shall verify actual dimensions of all openings before manufacture of doorsets, by field measurements.

#### 1.11 CONTRACTOR CORES

- A. Allowance shall be made for the provision of Contractor Cores, whereby upon Practical Completion, the Contractor Cores are removed, guaranteeing the integrity of the permanent cylinders from keys retained by unauthorised persons.
- B. Assemble and fix carefully and accurately using fastenings with a matching finish supplied by the ironmongery manufacturer. Prevent damage to ironmongery and adjacent surfaces. At completion check, adjust and lubricate as necessary to ensure correct functioning.

#### 1.12 WARRANTY

- A. The successful Subcontractor will be expected to submit to the Employer (under the terms of the Main Building Contract) a warranty guaranteeing the design, installation and performance

- of the products and workmanship for a period of twenty years from the date of Practical Completion.
- B. Guarantee to replace any part of system which fails in material or workmanship shall be provided by the Subcontractor.
    1. Failure of materials or workmanship includes, but is not limited to, excessive water leakage or air infiltration, excessive deflections, interstitial condensation, faulty operation, deterioration or discolouration of finish in excess of normal weathering, and defects in hardware, weather stripping, and other components, and loss of hermetic seals.
    2. Guarantee to cover the costs of dismantling, removing, making new parts, making good to adjacent/surrounding surfaces, finishing and re-fixing to match existing.
    3. Guarantee period commences at date of Certificate of Practical Completion and is to be submitted to Employer's Representative at tender stage for approval prior to nomination.
    4. Finishes: Submit 2 copies of written guarantee agreeing to remove, re-finish, and re-fix any element which shows deterioration of coating affecting colour, gloss or bonding, or abrasion resistance beyond that specified within 20 years of the date of Practical Completion.
  - C. Warrant doors free of defects as set forth in the door manufacturer's standard door warranty. Provide manufacturer's warranty for all doors for a period of two years from the date of Practical Completion.

### 1.13 DOORS GENERALLY

- A. The door sets/ door assemblies shall be designated in accordance with the definition outlined within EN 12519; namely:
  1. Fire Door set: 'A complete unit consisting of a door frame and a door leaf or leaves supplied with all essential parts from a single source.'
  2. Fire Door Assemblies: 'A complete assembly as installed, including door frame and one or more leaves, together with its essential hardware supplied from separate sources'.
- B. Unless otherwise stated, all doors shall be classified as 'Severe Duty' in accordance with DD 171.
- C. Unless stated otherwise all door systems referred to herein shall be door assemblies (as defined herein) in which ironmongery apertures, seals, slots and vision panels are separately formed prior to pre-finishing.
- D. Unless stated otherwise, all door systems shall be factory prefinished, arriving on site fully protected with a non-inflammable protective material compliant with LPS 1207.
- E. This Specification shall be read in conjunction with the Door and Ironmongery Schedule, Drawings and Acoustic Consultant's Report, which shall be in the vehicles, to convey the following, specific information:
  1. Configuration; i.e.:
    - Single leaf
    - Double leaf (equal pair)
    - Leaf and half (unequal pair)
    - Single swing
    - Double swing
  2. Door reference
  3. Dimensions
  4. Fire performance rating
  5. Acoustic performance rating (where a value is known)
  6. Facing type – general.

### 1.14 FIRE DOORS AND DOOR FRAMES GENERALLY

- The door assemblies, including the installation method within door openings, shall comply with the following fire rating requirements:
- A. Doorsets and door assemblies within openings, including ironmongery (refer to Door Hardware Section 08 71 00), shall be CE Marked and achieve the fire rating indicated on the 'Door and Ironmongery Schedule' and shall be independently tested to the relevant parts of BS 476 or assessed under the Exova Warrington Certifire Services. 'Fire Resisting Doors and Doorsets Quality Assurance Scheme'.
  - B. Doors shall be marked with an identifying label and plug, in accordance with the scheme. Copies of test certificates or assessments shall be provided for inspection.  
Door assemblies are divided into the following categories:
    - Type: 30 minutes: ½ hour (FD-30/30)
    - Type: 60 minutes: 1 hour (FD-60/60)
    - Type: 90 minutes: 1½ hour (FD-90/90)
  - C. Refer also to the Fire Safety Certificate Drawings and the Fire Safety Certificate Report.
  - D. Copies of test certificates shall be provided to the Employer's Representative prior to manufacture.

- E. All components, substrates and finishes shall satisfy Class 0 surface spread of flame in accordance with the requirements of the Technical Guidance / Approved / Approved Document Part B of the Building Regulations and the requirements of the Employer's Representative and, unless otherwise specified, indicated or agreed.
- F. Fire doors and frames including fire seals and all associated materials and installation shall comply with the requirements of BS 8214.
- G. Fire safety signs shall comply with BS 5499: Part 1 and shall be satin finished stainless steel / aluminium discs 75mm diameter and set with their face flush with the door surface. Signage shall be as indicated on the Door and Ironmongery Schedules.
- H. Provide independently certified evidence that all specified variants of components comply with specified performance requirements:  
Third-party accreditation by UKAS approved body. All doors to be Tekentrup certified and badged.
- I. All Fire Door sets are to be made available to the Employer's Representative and Fire Safety Consultant for inspection of all elements including but not limited to fire and smoke seals, prior to the installation of architraves and over cladding of doors and frames.

#### 1.15 REGULATORY REQUIREMENTS FOR FIRE-RATED DOORS

- A. FIRE-RATED ASSEMBLIES: Complying with BS476, part 22, 'Certifire' accredited, and listed and labelled by a qualified testing agency acceptable to authorities having jurisdiction for fire protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to BS 476, part 22.
- B. SMOKE - AND DRAFT- CONTROL ASSEMBLIES: Provide an assembly with gaskets listed and labelled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to 'Certifire' and installed in compliance with BS476, part 22.
- C. OVERSIZE FIRE-RATED DOOR ASSEMBLIES: Provide certification by a qualified testing agency.
- D. FIRE-RATED, BORROWED-LIGHT ASSEMBLIES: Complying with BS476, part 22 and listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to UL 9. Label each glazed light.
- E. LABELS: Fire doors and frames shall bear the label of 'Certifire', attesting to the rating required. Testing shall be in accordance with BS476, part 22, 'Certifire' accredited. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

#### 1.16 FIRE CERTIFICATION

- A. Fire certification and assessments shall be based on primary test evidence undertaken and validated by independent testing authorities Exova Warrington fire.
- B. Fire Doorsets to be installed shall achieve FD30, FD60, FD90 and FD120 certification, as detailed in the Fire Safety Certificate documents and drawings and the Door Schedule. Intumescent and integrated cold smoke seals shall be factory fitted to all doorsets to comply with performance requirements.
- C. All fire doorsets shall be fitted in accordance with BS 8214:2008, Code of practice for fire door assemblies. All fire doors shall be installed by members of an independent certified installation scheme, such as FIRAS, Trada, IFC or any equivalent third-party installation certifier.
- D. CE Mark fire doorsets to EN 16034 – this standard applies to all doorsets, inclusive of ironmongery.

#### 1.17 DECLARATIONS OF CONFORMANCE

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
- The performance requirements for the project.
- The technical specifications standards described herein.
- From July 2014 Structural steelwork and aluminium fell under the CPR and therefore requires DOPs and CE Marking to be affixed to show compliance with EN 1090-1.

#### 1.18 COORDINATION

- A. Coordinate anchorage installation for fire-rated and non fire-rated metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete

inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

- B. Co-ordinate security hardware for electrical hardware and deliver in time for installation of doors.
- C. Co-ordinate with the Building Management System (BMS) for the Project to ensure all locking and Master key arrangements are in place.

#### 1.19 SINGLE SOURCE WARRANTY

All components and 'build-up of components' shall be covered by a single source warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified. All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions. Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Employer's Representative.

#### 1.20 DOORSET MANUFACTURER'S PROVISION OF ON SITE TRAINING

The fire-rated metal door manufacturer(s) are to provide 'toolbox talks' on site, on appropriate installation and fixing requirements for all fire-rated metal doorsets and frame products to be installed.

The Contractor shall demonstrate the manufacturer(s) have visited site and provided Instruction on correct installation for each type specified.

Inspections: Fire-rated metal door manufacturer(s) to Inspect installation of each fire-rated metal doorsets (frequency of such site visits to be agreed with the Employer's Representative and the Employer's Representative) to ensure appropriate and correct installation(s) and complete an inspection report for each visit.

Verification: The fire-rated metal door manufacturer(s) to verify correct installation of each inspected fire-rated metal doorset type.

Warranty: Fire-rated metal door manufacturer(s)) to provide Project Specific Performance Warranty(s) upon completion of the installation of the fire-rated metal doorset types.

The Employer's Representative will not accept installations of fire-rated metal doorsets which have not been approved by their manufacturer(s), and which fail to comply with the requirements of Exova Warrington, Certifire requirements.

#### 1.21 TESTING REQUIREMENTS

- A. Provide test reports to certify fire rating, sound rating, air and water tightness of all doors being proposed by tenderer. Prior to the commencement of construction on site, reports shall be provided, in English, which state for all tests:
  - 1. The nature, date and location of test.
  - 2. The test institute and author of the report.
  - 3. The accreditation of the test institute.
  - 4. Description of the sample tested.
  - 5. Description of test standard procedure.
  - 6. Description of sample performance under test.
  - 7. Details of any changes made to the sample, pre-tests, or re-tests required to achieve specified performance.
  - 8. Comment on reasons for observed test performance and suitability of the construction to its intended use.
- B. The Contractor shall include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification. The provision of testing data or the carrying-out of tests does not relieve the Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.

#### 1.22 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed with a maintenance free life in excess of 20 years. Within the period of 'maintenance free life' the assembly shall perform at or above the levels specified elsewhere. In accordance with BS ISO 15686-5:2008 'Buildings and constructed assets. Service life planning. Life cycle costing'.
- B. The term 'Maintenance' shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.

- D. COMPONENT PARTS: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Employer's Representative must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.
- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.23 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Validation according to the Eco-Management and Audit System (EMAS).
  - 3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. Metal louvre panels and associated systems as designed, supplied and installed by a manufacturer regularly engaged in the design and production of such systems.
- C. Subject to compliance with requirements, provide products by one of the approved available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Fireblock Ireland, Udaras Industrial Estate, Ballymakeera, Co. Cork

Tel: +353 (0)264 5560. Fax: +353 (0)264 5911. Email: info@fireblock.ie. www.fireblock.ie

Best of Steel, BOS GmbH, Lütkenfeld 4, D-48282, Emsdetten, Germany

## SECTION 08 11 13

**PART 2 – PRODUCTS****EDR-001– EXTERNAL GRADE STEEL SECURITY DOORSETS**

Drawing references: Refer to plans, door elevations and Door Schedule.

Variant Conditions:

- Single leaf or double leaf: Refer to Door Schedule and associated drawings.
- LH / RH swing: Refer to design drawings.

Fire performance: Refer to Door Schedule and associated drawings.

Smoke control: Refer to Door Schedule and associated drawings.

Category: Heavy duty as defined within DD 171.

System manufacturer: Robust, Fireblock or equal and approved.

Third-party accreditation by UKAS approved body. All doors to be Tekentrup certified and badged.

Fire-rated steel doors to be tested and positively assessed to BS 476: part 22: 1987 to provide a fire resistance performance for integrity of up to 120 minutes. Refer to drawings.

Certified high security resistance to comply with the requirements of PAS 23/24.

Certified Security Rating: **SR2 tested to LPS1175**. (Secured by Design requirement).

SIZE:

- Single doors – 55 mm thick door leaf to suit a clear opening of up to 1200mm wide x 2400mm high.
- Double doors – 59 mm thick door leafs to suit a clear opening of up to 2000mm wide x 2850mm high.
- Door supplier to confirm door sizes as per door schedule can be achieved to meet certification.

LEAF:

- Zinc coated 1.5mm Magnelis mild steel door skins. Nominal thickness 55 - 61mm.
- Core: Self-support resin impregnated honeycomb core or mineral wool with steel straighteners.
- Front face of door leaf shall be flush with front edge of frame.

Security shall include:

- Overlap jointing to frame to prevent jemmying.
- Reinforced and insulated core.
- Anti-pick, high security cylinder lock, under the project Master Key plan.
- Doors shall be morticed, reinforced, drilled and tapped for three / four templated hinges.

HINGES:

3 / 4 Number template drilled CE Marked and tested to EN 1935: 2002 Grade 13 or 14 in satin stainless steel, shrouded or concealed bearing type fitted to each leaf.

Heavy duty hinges with dog-bolts.

Closer: Certifire approved.

VISION PANELS:

Refer to Design Intent Drawings, APPROVED DOCUMENT M compliant, DDA compliant.

Provide clear safety glass vision panel, size as indicated on the Design Drawings.

LOUVRES:

Construction: 400x450mm or 400x675mm.

On double doors, an astragal shall be folded into the leading edge of one leaf to improve sealing. Complete with factory fitted door limiting stay / wind restrictors.

FRAME:

Profiled, thermally broken, insulated core metal door frame. Mechanically fixed.

Single Rebate frame. Folded from 1.6mm Magnelis.

Frame shall be flush with front face of adjacent rendered blockwork.

Standard Steel Security Frame Construction.

FINISH:

Factory applied polyester powder coated in RAL colour to be agreed with the Employer's Representative. Extra Life C5-M Marine Grade finish.

THRESHOLD:

Low profile Std 15mm threshold DDA compliant.

SEALS:

Perimeter seals to satisfy the stipulated performance criteria; EPDM weather seals, acoustic seals and smoke seals.

IRONMONGERY: Refer to Door Schedule for complete ironmongery set.

Hardware – All door hardware proposed to be verified as compliant by door supplier. Fire escape door hardware to be fitted in compliance with BS EN 1125 or BS EN179.

Fitting of surface ironmongery is carried out by the doorset manufacturer.

All ironmongery must meet the requirements of Part M of the Building Regulations.  
Doors to be co-ordinated and to have wire ways for alarm / access control systems.

**WALL CONSTRUCTION:**

The opening must be fully formed from a material with sufficient composition strength to withstand a minimum load/fixing of 7N/nm<sup>2</sup> or as certified requirements.

EDR-002 – EXTERNAL GRADE GALVANISED STEEL DOORSETS

N/A

EDR-003 – TEMPORARY EXTERNAL GRADE STEEL SECURITY DOORSETS (FIRE-RATED)

Allow for 1 No. 60mins. fire-rated external grade single steel security door per temporary stairway tower.

Compliance with BS 476 Part 22 1987 and EN 1164-1 2000.

System manufacturer: Fireblock or equal and approved.

Third-party accreditation by UKAS approved body. All doors to be Tekentrup certified and badged.

Door leaf: 52mm thick to suit a clear opening of 900mm wide x 2200mm high.

Allow for all associated framing, trimming and secondary steel.

Allow for the re-instatement of façade and any other permanent building components.

To be read in conjunction with clause STA-002 – EXTERNAL STAIRWAY TOWERS

IDR-001 – INTERNAL GRADE METAL DOORSETS

Drawing references: Refer to plans, door elevations and Door Schedule.

Variant Conditions:

- Single leaf or double leaf: Refer to drawings.
- LH / RH swing: Refer to drawings.
- Fire-rated or non fire-rated: Refer to drawings.

Fire performance: Refer to Door Schedule.

Smoke control: Refer to Door Schedule.

Acoustic Performance: Rw 32dB generally. Rw 53dB for doors to office areas and meeting rooms.

Category: Heavy duty.

For installation internally.

System manufacturer: Fireblock or equal and approved.

Third-party accreditation by UKAS approved body. All doors to be Tekentrup certified and badged.

Fire-rated steel doors to be tested and positively assessed to BS 476: part 22: 1987 to provide a fire resistance performance for integrity of up to 120 minutes. Refer to drawings.

SIZE:

- Single doors – 52 mm thick door leaf to suit a clear opening of up to 1100mm wide x 2850mm high (maximum surface area 3.08m<sup>2</sup>).
- Double doors – 52 mm thick door leaves to suit a clear opening of up to 1800mm wide x 2850mm high (maximum surface area 5.13m<sup>2</sup>).

Coordinating height from finished floor level to structural opening in all cases.

FACE: 1.2 mm galvanised steel interlocked to the back face and fixed on the top and bottom edge of the door blade, powder coated to standard RAL colour range of the customer's choice.

Sub frame: 2mm folded galvanised steel (25 x 41 x 25) u-channel to perimeter of door and three channels vertically positioned over the width of the door blade.

BACK: 1.2mm galvanised steel interlocked to the front face and fixed on the top and bottom edge of the door blade, powder coated from full RAL colour range to the Employer's Representative's selection via samples.

CORE: Stiffened, insulated and sound deadened honeycomb technology core, pre-expanded and laminated.

IRONMONGERY: Heavy duty ironmongery in a brushed stainless steel finish. Refer to Door Schedule for complete ironmongery set.

Hinges: 3 / 4 Number template drilled CE Marked and tested to EN 1935 : 2002 Grade 13 or 14 in satin stainless steel, shrouded or concealed bearing type fitted to each leaf.

Closer: Certifire approved.

Kick plates: Where required shall be Stainless Steel Brush finish – standard height 200mm as shown on the drawings.

Doors to be co-ordinated and to have wire ways for alarm / access control systems.

Fitting of surface ironmongery is carried out by the doorset manufacturer.

All ironmongery must meet the requirements of Part M of the Building Regulations.

GLAZED DOORS / VISION PANELS: APPROVED DOCUMENT M compliant vision panels in each full door leaf to be factory fitted as dimensioned and detailed on door pattern drawings. Clear safety glazing to be PVB sheet laminated glazing with annealed or toughened glass. Resin laminated glass is not accepted.

Clear fire-rated glazing with annealed or toughened glass with insulating laminate, detailed strictly in accordance with manufacturer's test data and recommendations. Pyroacet / Pyran or similar to meet requirements.

Bedding: Intumescent/ acoustic glazing compound or proprietary glazing channel dependent upon the method on which the manufacturer's performance certification is based.

Face of glazing bead to be detailed to the Employer's Representative's approval. Fixing of glazing bead to be concealed.

LOUVRE: Fireblock 240 minute fire-rated unit max size 500mm x 500mm.

FINISH: Factory applied polyester powder coated in RAL colour to be agreed with the Employer's Representative. Minimum 40 microns.

FRAME: The frame shall be a composite element of the door assembly and be supplied with factory fitted hinges and lock, integral stainless steel striking plates, apertures for slide arm overhead door closers, etc. as required. BOS Duo 15Z system - Refer to FRA-001 below.

FIXING: Using proprietary cramps, fix to walls, partitions or structural frames strictly in accordance with manufacturers tested head and jamb details. Include all fixings, framing, bracketry, flashings, gaskets, sealants, ironmongery and accessories necessary to complete the works.

#### FRA-001 – METAL FRAMES TO INTERNAL DOORS

BOS Duo 15Z system 2-part split frame with levelling anchor and shock-absorbing buffer, for installation in completed wall openings for brick walls, stud walls and lightweight partitions.

The frame shall be a composite element of the door assembly and be supplied with factory fitted hinges and lock, integral stainless steel striking plates, apertures for slide arm overhead door closers, etc. as required.

PRODUCT REFERENCE: wBsd Type K. Single rebated with integrated seal in the stop and with screw fixed mitres.

SIZE: to suit specific wall type and in accordance to manufacturer's tolerances. Adjustable from -5mm to +15mm of specified wall thickness: Refer to Door Schedule.

Fire performance: Certified in accordance with BS 476: Part 22: 1987. Refer to Door Schedule for specific requirements.

Allow for wire ways for alarm / access control systems.

MATERIAL: Hot dip Galvanised thin sheet steel to EN 10143, 1.5mm thick (10.8kg/m<sup>2</sup>). Zinc layer 150g/m<sup>2</sup> minimum in accordance with DIN 10147.

FINISH: Factory applied primer and polyester powder coated in RAL colour to be agreed with the Employer's Representative. Brillux type M sort 8341 polyester powder coated – 60-70µm.

#### FRA-002 – THERMALLY BROKEN METAL FRAMES TO EXTERNAL SERVICE HATCHES

Thermally broken metal frame system for external service hatches.

The frame shall be a composite element of the hatch assembly and be supplied with factory fitted hinges and lock, integral stainless steel striking plates, apertures for slide arm overhead door closers, etc. as required.

PRODUCT REFERENCE: MHB SL30-ISO profile system.

SIZE: to CSA drawings and in accordance to manufacturer's tolerances.

Wind and Water tightness: To VMRG standard 6A, from 150 Pa, class 4 of EN 12208.

MATERIAL: Solid bare steel S235 or solid stainless steel with thermal bridge break.

FINISH: Factory applied primer and polyester powder coated in RAL colour to be agreed with the Employer's Representative.

### 2.1 GENERAL

- A. Refer to the Fire Safety Certificate documentation and Exova Warrington Fire research 'Certifire' guidance for fire doors.
- B. Vision panels to be included where indicated in accordance with statutory regulations and as noted on the Door Schedule.
- C. GLAZING TO DOORS:  
The Door Supplier is to refer to the Door Schedule, Drawings and Fire Safety Documentation for the project to ensure that the appropriate glazing material is used for each applicable door in terms of statutory regulations, operational and Fire Safety performances.

### 2.1.1 MANIFESTATION TO GLAZED SCREENS ADJACENT TO DOORS

- A. Glazed walls should conform to BS 6262 'Glazing for buildings', BS 8300 'Design of Buildings and their approaches to meet the needs of disabled people'.
- B. The surface of glazed walls and screens that are adjacent to doors, or form part of an enclosure, are to be clearly highlighted with a manifestation which contrasts visually with the surface behind it under both natural and artificial lighting conditions.
- C. This manifestation will be located within two zones, from 850 mm to 1 000 mm from the floor and from 1 400 mm to 1 600 mm from the floor.  
Suitable manifestation will take the form of a continuous or broken line, sign, logo or patterning on the glass that covers at least 10% of the glazing area within each zone.
- D. Manifestation is subject to the Employer's Representative's approval via samples.

### 2.1.2 LIGHT REFLECTANCE VALUE (LRV)

In accordance with the requirements of Building Regulations 2010, APPROVED DOCUMENT, Part M Access and Use and BS 8300:2009 +A1:2010 Design of buildings and their approaches to meet the needs of disabled people – Code of practice, the following applies to the LRVs of the surface finishes:

differences in LRV shall be used to assess the degree of visual contrast between surfaces such as floors, walls, doors and ceilings and between key fittings/fixtures and surrounding surfaces, and

The LRV of a wall shall be 30 points different from that of the ceiling and of the floor.

To avoid giving the wrong impression about the size of a room, skirting's shall have the same LRV as the wall so that the junction between the skirting and the floor marks the extent of the room.

The LRV of doors and architraves may be the same but should differ by at least 30 points from the wall in which they are located.

The LRV of doors and ironmongery should differ by at least 15 points from the door on which they are located.

Refer to the Employer's Representative for colour selections of walls, ceilings, joinery etc. All to be selected from the coating manufacturer's full range of RAL and/or BS colours.

### 2.2 SINGLE SOURCE MANUFACTURER

- A. Source Limitations: Obtain fire-rated metal doorsets from a single source from single manufacturer.

### 2.3 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with BS476, part 22, 'Certifire' accredited and listed and labelled by a qualified testing agency acceptable to authorities having jurisdiction for fire protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to BS476, part 22.
  - 1. Smoke - and Draft-Control Assemblies: Provide an assembly with gaskets listed and labelled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to BS 9999:2008 Code of practice for fire safety in the design, management and use of buildings, UL 1784 and installed in compliance with BS 476, part 22.
  - 2. Oversize fire-rated door assemblies: Provide certification by a qualified testing agency.
  - 3. Temperature rise limit: At exits provide doors that have a max transmitted temperature. End point of not more than 250°C above ambient after 30 minutes test exposure.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with BS476, part 22 and listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to 'Certifire'. Label each glazed light.
- C. Thermal resistance: Thermal rated doors (insulated) shall have a U value of not more than 0.26w/m<sup>2</sup>k, when tested according to ASTM C 1363.
- D. Labels: Fire doors and frames shall bear the label of 'Certifire' attesting to the rating required. Testing shall be in accordance with BS476, part 22, 'Certifire' accredited.  
Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

### 2.4 OVERDOOR FIRE-RATED METAL PANELS

- A. Provide fire-rated metal panels of same materials, construction, and finish as adjacent door assemblies.

### 2.5 FRAME ANCHORS

- A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 1.0 mm thick, with corrugated or perforated straps not less than 51 mm wide by 254 mm long; or wire anchors not less than 4.5 mm thick.
  2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 1.0 mm thick.
  3. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 9.5-mm- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 1.0 mm, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 51-mm height adjustment. Terminate bottom of frames at finish floor surface.

## 2.6 PERFORMANCE REQUIREMENTS

### A. STRENGTH REQUIREMENTS

Strength of Doors and Frames: Ensure that the works, including ironmongery, meet the 'heavy duty' category as defined in DD 171 or an equivalent international standard.

Provide evidence to demonstrate that the works, including ironmongery, have been tested to meet the minimum acceptance criteria given in DD 171 for the following:

- Slamming shut impact.
- Slamming open impact.
- Heavy body impact.
- Hard body impact.
- Torsion.
- Download deformation.
- Closure against obstruction.
- Resistance to jarring and vibration.
- Abusive forces on door handles.

Glass in doors: Comply with BS 6262.

Impact performance to achieve class A (class 1B1) to BS 6206 and EN 12600.

### B. SPECIFIC LIVE LOADS

A horizontal line load applied to the works, due to the occupants, in accordance with BS 6180 and EN 1991-1-7:2006+A1:2014 Eurocode 1. Actions on structures. General actions. Accidental actions.

A horizontal uniformly distributed line load of 2.2kN/m.

Uniformly distributed load applied to the infill of 1.5kM/m<sup>2</sup>.

A point load applied to any part of the infill of 1.5kN.

### C. HEAD RESTRAINT DETAIL

The slab or beam deflection experienced by a head restraint detail will slightly be dependent upon the construction sequence. If the head restraint is installed after construction of other finishes and partitions, then deflections experienced would be around span/ 500 or 20mm whichever is lesser. If some finishes are constructed after the head-restraint is installed, then the detail might experience slightly more deflection, indicatively around span/ 500 5mm or 25mm.

The works shall allow for head restraint details for concrete slab and beam deflections of the values above plus an additional 5mm.

The above clauses refer only to movements. The head detail should also be designed to work with the tolerances of concrete construction which are as stated in the National Structural Concrete Specification (NSCS).

### D. CONDENSATION

All components are to be designed and installed by the Subcontractor to prevent condensation on the inner material or surface of any component.

### E. VIBRATION

The tenderer is required to include in the tender return proposals for discouraging amplification of vibration excitation due to airborne or structure-borne sources by means of damping and avoidance of lightweight, resonant and/or loose components and fittings.

## 2.7 ADDITIONAL HARDWARE REINFORCEMENT

- A. Provide the minimum lock blocks to secure the specified hardware. The measurement of top, bottom, and intermediate rail blocks are a minimum 125mm by full core width. Comply with the manufacturer's labelling requirements for reinforcement blocking, but not mineral material similar to the core.

## 2.8 FABRICATION

- A. Marking: Provide, on the inner reveal a permanent badge for each door with a 'Certifire' Fire Rating, brand, stamp, or other required identifying mark indicating integrity, quality and construction of the door, doorset.

## 2.9 MATERIALS

- A. Cold-Rolled Steel Sheet: BS ISO 16162:2012 Cold-rolled steel sheet products. Dimensional and shape tolerances. ASTM A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: EN 10111:2008 Continuously hot rolled low carbon steel sheet and strip for cold forming. Technical delivery conditions ASTM A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods ASTM A 653M, Commercial Steel (CS), Type B with min Z180 or ZF180 metallic coating.
- D. Frame Anchors: BS 1245:2012 Pedestrian doorsets and door frames made from steel sheet. Specification. ASTM A 879M, Commercial Steel (CS), 12G coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008M or ASTM A 1011M, hot-dip galvanized according to ASTM A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching fire-rated metal frames of type indicated.
- G. Grout: EN 480-1:2014 Admixtures for concrete, mortar and grout. Test methods. Reference concrete and reference mortar for testing.
- H. Vision panels to be included where indicated in accordance with statutory regulations.

## 2.10 FABRICATION

- A. General: Doors shall be provided as a 'doorset' with the door frame and hardware as a factory fabricated set.
- B. Fabricate fire-rated metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- C. Tolerances: Fabricate to Exova Warrington Fire Research 'Certifire' instructions.
- D. FIRE-RATED METAL DOORS:
  - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.66 mm, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 152 mm apart. Spot weld to face sheets no more than 127 mm o.c. Fill spaces between stiffeners with glass- or mineral-fibre insulation.
  - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
  - 3. Vertical Edges for Single-Acting Doors: Bevel edges 3.2 mm in 51 mm.
  - 4. Top Edge Closures: Close top edges of doors with flush closures and provide flush closures at exterior doors of same material as face sheets.
  - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
  - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors only if required by 'Certifire' for fire-performance rating. Extend minimum 19 mm beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency, Warrington Fire Research 'Certifire'.
- E. FIRE-RATED METAL FRAMES:
  - Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Sidelight and/or Transom Bar Frames: Provide closed tubular members with no visible face seams or joints and weld flush face joints continuously, ground and made smooth, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners.
  - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 406 mm from top and bottom of frame. Space anchors not more than 813 mm o.c., to match coursing, and as follows:
      - Two anchors per jamb up to 1524 mm high.
      - Three anchors per jamb from 1524 to 2286 mm high.
      - Four anchors per jamb from 2286 to 3048 mm high.
      - Four anchors per jamb plus one additional anchor per jamb for each 610 mm or fraction thereof above 3048 mm high.
    - b. Post-installed Expansion Type: Locate anchors not more than 152 mm from top and bottom of frame. Space anchors not more than 660 mm o.c.
  6. Head Anchors: Two anchors per head for frames more than 1067 mm wide and mounted in metal-stud partitions.
  7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
  8. Terminated Stops: Terminate stops 152 mm above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure.  
Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- F. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- G. **HARDWARE PREPARATION**  
The Ironmongery and Door Suppliers are to refer to the Door Schedule and Drawings and liaise with each other to ensure that the correct ironmongery is provided for each door installed. Provide minimum hardware reinforcing gauges as specified in Exova Warrington Fire Research 'Certifire' information.  
Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of Exova Warrington Fire Research 'Certifire'.  
Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of Exova Warrington Fire Research 'Certifire' as applicable. Punch door frames, with the exception of frames that will have weather stripping or gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.  
Factory prepare fire-rated metal work to receive template mortised hardware; include cut-outs, reinforcement, mortising, drilling, and tapping.
1. Reinforce doors and frames to receive non-templated, mortised, and surface mounted door hardware.
  2. Comply with applicable requirements in Exova Warrington Fire Research 'Certifire' for preparation of fire-rated metal work for hardware.
- H. Stops and Mouldings: Provide stops and mouldings around glazed lights where indicated. Form corners of stops and mouldings with butted or mitred hairline joints. Min 0.8mm thick, fabricated from same material as door face in which they are installed.
1. Single Glazed Lights: Provide fixed stops and mouldings welded on secure side of fire-rated metal work.
  2. Multiple Glazed Lights: Provide fixed and removable stops and mouldings so that each glazed light is capable of being removed independently.
  3. Provide fixed frame mouldings on outside of exterior and on secure side of interior doors and frames formed integral with hollow metal frame, a min of 16mm high.
  4. Provide loose stops and mouldings on inside of fire-rated metal work, min 0.8mm thick fabricated from same material as frames in which they are installed.
  5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.11 STEEL DOORSET FINISHES

- A. Finish as delivered: Polyester powder coated to 30% gloss level, to agreed colour selected from RAL range.
- B. Galvanised finish to meet the requirements of I.S EN ISO 1461: 2009.

## 2.12 OPENING PRESSURES

Ensure that the maximum opening pressures required to open fire-rated or non-fire-rated doors on disabled access routes are in accordance with the requirements of BS 8300.

The opening force, when measured at the leading edge of the door, should be no more than 30 N from 0° (the door in the closed position) to 30° open, and no more than 22.5 N from 30° to 60° of the opening cycle (BS 8300 does permit a tolerance of up to 35 N, depending on the location from which the measurement is taken and the accuracy of the force meter used).

Where hinged or pivoted fire resisting doors need to be accessible by disabled people, the door closing devices fitted should have 'controlled' action, conforming to the requirements of EN 1154:1997, Annex A, or be of a variable power type and conform to the recommendations above.

The Door supplier is to liaise with the Ironmongery supplier to ensure that the power assisted door fittings to be used are the optimum solution for the door type and location.

## 2.13 STRUCTURAL SUPPORTS TO OVERSIZED / METAL DOORSETS

There is a requirement for secondary steel support within stud partitions to provide additional support for metal doorsets.

The support system shall comprise of secondary steel to Contractor's design, comprising:

Minimum square box section galvanised mild steel at centres and lengths to form goal posts with mild steel plates welded to sections with predrilled holes for fixing to RC concrete soffit and floor. Dimensions of steelwork supports to be determined by calculations by the Structural Engineer. All predrilling, welding and finishing of welds to be completed prior to galvanising the steel.

The equipment shall be attached to the support goal posts and partitions as recommended by the equipment manufacturer to give the necessary support and integrity for the structure.

Concealed structural fixing system as agreed with the Employer's Representative.

## SECTION 08 11 13

**PART 3 – EXECUTION**

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive non-templated, mortised, and surface mounted door hardware.

## 3.3 INSTALLATION

- A. General: Install fire-rated metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Fire-rated metal Frames: Install fire-rated metal frames of size and profile indicated. Comply with manufacturer's instructions and Warrington Fire Research 'Certifire' as required by standards specified.
  1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

At fire-rated openings, install frames according to Comply with manufacturer's instructions, Warrington Fire Research 'Certifire', as required by standards specified.

Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

Install frames with removable stops located on secure side of opening.

Install door silencers in frames before grouting.

Remove temporary braces necessary for installation only after frames have been properly set and secured.

Check plumb, square, and twist of frames as walls are constructed.

Shim as necessary to comply with installation tolerances.

Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
  2. FLOOR ANCHORS: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
  3. METAL-STUD PARTITIONS: Solidly pack mineral-fibre insulation inside frames.
  4. MASONRY WALLS: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mineral fibre insulation.
  5. CONCRETE WALLS: Solidly fill space between frames and concrete with mineral-fibre insulation.
  6. CEILING STRUTS: Where doors are located in stud partitions not framed to structure above, extend ceiling struts above ceiling to support door frame.
  7. IN-PLACE CONCRETE OR MASONRY CONSTRUCTION: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  8. IN-PLACE METAL OR PARTITIONS: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  9. Installation Tolerances: Adjust fire-rated metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. SQUARENESS: Plus or minus 1.6 mm, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. ALIGNMENT: Plus or minus 1.6 mm, measured at jambs on a horizontal line parallel to plane of wall.

- c. TWIST: Plus or minus 1.6 mm, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
- d. PLUMBNESS: Plus or minus 1.6 mm, measured at jambs at floor.
- C. Fire-rated metal Doors: Fit fire-rated metal doors accurately in frames, within clearances specified below. Shim as necessary.
  1. Non-Fire-Rated Steel Doors:
    - a. Between Door and Frame Jambs and Head: 3.2 mm plus or minus 0.8mm.
    - b. Between Edges of Pairs of Doors: 3.2 mm plus or minus 1.6 mm.
    - c. Between Bottom of Door and top of threshold max 9.5mm plus or minus 0.8mm.
    - d. Between Door Face and Stop: 1.6 mm to 3.2 mm plus or minus 0.8mm.
  2. Fire-Rated Doors: Install doors with clearances according to BS476, part 22 and 'Certifire' accredited.
  3. Smoke-Control Doors: Install doors and gaskets according to BS476, part 22.
- D. Vision panels to be included where indicated in accordance with statutory regulations and with fire-rated glass manufacturer's written instructions.
  1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 230 mm o.c. and not more than 51 mm o.c. from each corner.

### 3.4 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s).
7. Independent certification by UKAS approved body.
8. Warranties: Refer to Clause No's 1.12 & 1.19.
9. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
10. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

### 3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition.  
Remove and replace defective work, including fire-rated metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from fire-rated metal work immediately after installation.
- C. All doors factory finished supplied.
- D. Factory-Finish Touch up: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

### 3.6 WASTE MANAGEMENT

- A. As specified in Waste Management Plan and as follows. Separate waste products from contaminants. Do not include Hollow Metal Doors and Frame materials with wood, plastic, metal, or any glass fibre, vinyl, decorative paper, or other finish. Place in designated area and protect from moisture and contamination.
- B. Identify manufacturer's policy for collection or return of remaining unused material and packaging material. Institute demolition and construction recycling to take advantage of manufacturer's programs. When such a service is not available, seek local recyclers to reclaim the materials.

**END OF SECTION 08 11 13**

**SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. To be read with the Contract, Drawings, and other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 THE PROJECT**

- A. Refer to location and general description of the development in Section 01 10 00 (General Summary of Requirements).

**1.3 THE WORKS**

- A. It shall be the responsibility of the glazing subcontractor (referred to as the Specialist Façade Subcontractor and SFS) to procure all expertise, materials and services he requires to complete the façade envelope of the building as identified in this document.  
Test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation. To include all items necessary for full completion and finishing of the work, not necessarily included.  
The Specialist Façade Subcontractor shall ensure full compliance with the design intent and specification requirements. The Contractor shall be responsible for over-seeing the package and ensuring compliance but shall rely on the Specialist Façade Subcontractor (SFS) to deliver all requirements related to the glazing and cladding packages, including parapets and interfaces. The Works include all aluminium parapets, fascias, soffits, all glazing including curtain walling, point fixed glazing, fixed windows and glazed doors, fritting to glass where required, aluminium louvres, secondary steel, and all external doors within the building. Refer to the Sub-contract preliminaries from the Contractor for guidance on what additional elements are to be included in the Specialist Façade Subcontractor's package.  
All ground level vision glazing, including entrance glazing, shall incorporate laminated inner glass for security.
- B. Refer to the Sub-contract preliminaries and Design Intent Drawings for guidance on what elements are to be included in the specific Specialist Façade Subcontractor's package. Works include, but are not limited to, the following:  
FAC-010 – GLAZED CURTAIN WALLING SYSTEM

**1.4 AUTOMATIC OPENING VENTS**

The SFS shall include provision of automated opening vents, designed and tested in accordance with EN 12101 for smoke ventilation.  
To include proprietary interfacing and weathering of upstand constructions provided by the Contractor and Roofing Contractor. To include wind baffles in accordance with the manufacturer's location specific, project specific recommendations and EN12101 certification.  
Vents to be designed to provide weather resistance, insulation and resistance to condensation formation.  
Refer to specification Section 08 62 50 (Roof Lights and Access Hatches).

**1.5 ROOFLIGHTS**

The works include fixed glazed lights in the canopy. Refer to specification Section 08 62 50 Roof Lights and Access Hatches.

**1.6 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.  
DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT  
Building Regulations 2010  
IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

**1.7 DESIGN RESPONSIBILITY**

The Specialist Façade Subcontractor shall be responsible for the design development, supply chain QA, testing, engineering, logistics, delivery, coordination, installation, commissioning and warranting of the complete façade including, backing wall construction, secondary steel, glazing, doors, AOV's glazed screens, parapets and all interfacing constructions.  
The SFS shall provide ancillary certification to the Design Certifier and Assigned Certifier as required.

The Design Intent Drawings and this Contract Document are indicative of design intent and define the performance criteria, the approximate geometry of the exposed surfaces including joint positions, and detail the required principal materials and visible finishes.

The Specialist Façade Subcontractor shall be responsible for developing and completing the design in accordance with the above and the other Contract Documents, taking into account any additional criteria which, with his specialist knowledge, he believes are relevant.

The Specialist Façade Subcontractor may put forward alternatives for consideration by the Employer's Representative. Additionally, any suggested solutions described on the Design Intent Drawings or commented on the Specialist Façade Subcontractor's drawings shall not in any way relieve the Specialist Façade Subcontractor from his responsibility for the design and construction and installation of the whole of the Works taking into account all associated procurement, logistical and program requirements.

## 1.8 SPECIALIST FAÇADE SUB-CONTRACTOR'S ROLE

### A. The Specialist Façade Subcontractor shall:

1. Comply with all appropriate National and Local Government Regulations.
2. Liaise with the Contractor and Employer's Representative and provide all information necessary to complete the Health & Safety File complying with the Health and Safety Regulations and health and safety procedures set out by the Contractor.
3. Fully coordinate all design and installation solutions with interfacing contractors
4. Use only recognised good practices and comply with this Specification, all relevant, British and European Standards unless requirements conflict. If they do, the Employer's Representative shall be notified and shall make a decision as to which document takes precedence.
5. Prepare a detailed design, mock-up, testing and installation programme for the execution of the Works, including the design development, testing and mock-ups, and submit two copies of it to the Employer's Representative within four weeks of the Award of Contract. The program shall include provision of submissions, allowing minimum 14 days for review, re-submission as required to finalise acceptance by the Employer's Representative and Employer's Representative.
6. Prepare a detailed drawing list, related to elevations showing locations of 2 and 3D drawings, and identify when in the programme these will be produced.
7. Complete the design intent provided to produce Works that comply with the Architectural design intent and the technical requirements of this Contract Document.
8. Employ the services of a suitably experienced registered and chartered structural engineer, registered in Ireland, to carry out detailed audit of tolerances, design principles and deflections of interfacing steel structural elements, and to confirm acceptance of the proposed primary structure, particularly with regard to suitability for attachment of the Specialist Façade Subcontractor's proposed curtain walling. The same structural engineer shall carry out detailed analysis of all components including finite element analysis where required.  
He shall carry out complete design of all façade types and associated structural connections. He shall attend site on a minimum of 8 times during installation of the façade and report on his findings, confirming compliance of the installed elements with his design intent. Any deviation from the agreed structural design shall be highlighted and work stopped on that portion of the work.
9. Provide trade literature, samples of finishes, components and elements of the Works to demonstrate the quality of design, material and workmanship, methods of fabrication and obtain approval. Refer also to Clause 5.6 for minimum list of off-site quality control samples. On-site quality control samples are also required.
10. Present proposals in drawn and written form and modify them as required by the Employer's Representative to complete the design intent and achieve compliant solutions.  
Drawn proposals, where required by the Employer's Representative, shall be in the form of 3D sketches, exploded where necessary, of all interfaces, corners, edges and features. 3D sketches may be freehand. These sketches shall illustrate the proposals including the continuity of air and weather seals, vapour barrier, insulation, drainage routes and ventilation, allowance for movements, tolerances and fixings, and sequencing, shape and layering of elements at these locations.
11. Attend regular meetings with the Employer's Representative to discuss and develop the detailed design and provide calculations, samples and other supporting evidence to corroborate it as necessary.
12. Produce, and submit formally, design development drawings based on the compliant solutions, calculations and samples. As these are developed, ongoing checks shall be made to ensure that the principles adopted in (h) above are maintained.
13. Prepare the necessary shop drawings when and only when the design has been completed in compliance with this Contract Document for the system concerned. Drawings to be submitted

- in PDF, hard copy and measurable BIM and CAD formats for review by the team. Refer to the BIM manual.
14. Prepare thermographic modelling (2D full colour) of ALL systems and ALL interfaces and assemblies confirming location of air seal, dew point and U value. 3D thermal modelling shall be carried out where required at localized penetrations. Note, dew point to be demonstrated as being in a drained and ventilated zone. The Specialist Façade Subcontractor shall be required to obtain information regarding properties of interfacing constructions that his Works shall seal to. Calculations to take into account localised effects of brackets etc.
  15. Fabricate the specimens for off-site testing when and only when the necessary shop drawings have been completed.
  16. Provide samples, design development mock-ups, weather performance testing, acoustic assessment and quality control specimens (off-site and onsite) as required by this Contract Document.
  17. Test the specimens unless applicable test results are available and accepted by the Employer's Representative. Note, independent testing authorities to be used throughout.
  18. Carry out modifications to the design and construction of specimens and retest these in the event of failure during testing. Ensure any modifications to the design are incorporated into the design development drawings prior to manufacture of the Work for site.
  19. Proceed with fabrication when and only when the specimens have been tested successfully.
  20. Organise the delivery of components to the site so that the Works can be installed in proper sequence without omissions which would require modification of the design.
  21. Ensure that all people engaged in the design, fabrication and installation of the Works are adequately trained, proficient and experienced.
  22. Instruct all those engaged in the installation of the Works of the principles of its design, of any unusual details which might be overlooked and of the particular techniques to be used in its construction.
  23. Ensure an up-to-date set of appropriate drawings, reports and calculations is available on site for the installation team at all times.
  24. Provide on-site quality control samples and test these using an independent testing authority acceptable to the Employer's Representative at times suitable to allow inspection of all interior surfaces of the façade prior to covering up. Where covering up has occurred, the Specialist Façade Subcontractor shall remove this prior to testing and re-instate it at his cost after testing. Note, the Specialist Façade Subcontractor should program all testing to avoid this. Note, the Specialist Façade Subcontractor shall provide all access required for inspection during the testing.
  25. Ensure that the Works are installed to the agreed standards set by the quality control samples.
  26. Arrange for hose testing and combined air-and-water testing by the independent testing authority.
  27. Protect the Works.
  28. Commission all motorised elements. Commissioning to include twenty cycles of opening-closing of each motorised element using the appropriate signals from room switches, BMS and Fire board as appropriate (one cycle is closed to open to closed again).
  29. Provide a comprehensive maintenance manual and 'as-built' drawings at practical completion. Provide a draft version not less than 4 weeks prior to practical completion.
  30. Provide maintenance of all elements of the façade package for the duration of the defects liability period (minimum 12 months from hand-over to the Employer's Representative).
  31. Comply with all requirements of BCAR 2014.
  32. Provide training to the Employer's Representative's staff in the operation, maintenance and replacement of all elements of the Works. The Employer's Representative requires the timely provision of classroom and on-site instructions in the operation and maintenance of all building systems and installations to the Employer's Operation and Maintenance staff. These training services must be provided using the appropriate manufacturer's factory-trained personnel and/or qualified training representatives. The classroom and on-site training modules are to be scheduled in the project masterplan and will be supplemented with maintenance instructions, written in plain English and structured to provide to the Employer's staff a complete set of digital and hard copy maintenance volumes for all aspects of the buildings.

## 1.9 SUBMISSIONS

### 1.9.1 SCHEDULES EXTRACTED FROM TENDER SPECIFICATION

Two weeks after contract award, the successful tenderer shall be required to produce a coordinated schedule of Technical Submissions, including sample submissions.

The schedule shall set out all of the documentation, test certificates, drawings, maintenance manuals, warranty certificates and samples referred to in the agreed

Contract Specification. The schedule shall list dates when the submissions shall be produced. The schedule shall be reviewed with the Contractor and Employer's Representative and adjusted to suit the needs of all parties. As part of the Works, the Specialist Façade Subcontractor shall provide the submissions and organise the inspections given in the schedule of Technical Submissions extracted from the Tender Specification, at the times indicated.

The submission schedule shall take account of the requirement for items to be submitted in good time for review, re-submission and approval. Failure to achieve approval of submitted documents shall not relieve the Specialist Façade Sub-Contractor's obligations to achieve the requirements of the Contract Documents and the Contract Specification or meet the requirements of the contract program.

Provide a programme (over and above the protection and erection programme required by the Contractor) which shows the proposed drawing list, date for issue and date for acceptance by the Employer's Representative for the entire contract works.

The Employer's Representative reserves the right to amend the Specialist Façade Subcontractor's

information programme in order to ensure the satisfactory flow of information to other subcontractors or members of the project team irrespective of when information is needed by the glazing Specialist Façade Subcontractor for his own production programme.

### 1.9.2 PROCEDURAL MATTERS

The Specialist Façade Subcontractor shall assemble the submissions as required and submit these to the Employer's Representative for review by the appropriate member of the Design Team. He shall simultaneously issue information digitally in PDF format to other members of the design team as directed by the Employer's Representative with associated issue sheets. The recording of this process shall be in accordance with the requirements of the Contract Documents. It is intended that the Employer's Representative shall provide the following status to reviewed documents:

A: Permission to proceed as drawn (no changes permitted). Re-submit for Construction.

B: Incorporate all comments and proceed. Re-submit for Approval.

C: Incorporate all comments and re-submit prior to proceeding. Re-submit for Approval.

Re-submitted B and C status drawings/reports with changes not clearly clouded shall not be reviewed and shall be rejected. The Specialist Façade Subcontractor shall not be permitted to claim delay or cost where this occurs. The Employer's Representative shall reserve the right to down-grade from B status to C status, any submission that has repeatedly not incorporated all comments to the satisfaction of all parties. As stated in this Specification comments on submissions do not relieve the Specialist Façade Subcontractor of his responsibility to achieve the requirements of this specification and other contract documents including compliance with the agreed program for the project.

When Works are ready for inspection and/or testing, the Specialist Façade Subcontractor shall submit these to the Employer's Representative for review by the appropriate member of the Design Team. The notification and recording of this process shall be in accordance with the requirements of the Contract Documents.

Drawings must show any requirements for builder's work in connection with the Specialist Façade Subcontractor's installation. These works are to be carried out by the Specialist Façade Subcontractor within this subcontract. The Design Team's comments will relate only to general performance, aesthetic and overall functional matters, not to the detailed design and construction components which is to remain the complete and sole responsibility of the Specialist Façade Subcontractor.

The Design team's consideration of drawings and other technical submissions submitted by the Specialist Façade Subcontractor shall not in any way relieve the Specialist Façade Subcontractor from his responsibility in respect of the suitability of, accuracy of and programming of all such drawings and technical submissions, nor from his responsibility to provide elements suitable in dimensions for the location in which they are to be installed. The Design Team shall be entitled to rely upon the Specialist Façade Subcontractor's submissions with regard to the accuracy of their information.

The Design Team's consideration of the Specialist Façade Subcontractor's submissions will not relieve the Specialist Façade Subcontractor from his responsibility for rectifying errors or for supplying components and materials to the full satisfaction of the Design Team. Any modification required is to be re submitted within one week of receipt of the design team's comments or as otherwise agreed on the drawing schedule.

The details shown on the Design Intent Drawings are indicative of the Employer's requirements. The method of achieving the construction is the responsibility of the Specialist Façade Subcontractor, provided that it conforms to this specification and associated appearance. Where a quality control sample exceeds (is better than) the requirements of the Contract Specification, it shall become the minimum standard that all relevant Works shall achieve.

### 1.9.3 COMPLIANT TENDERS, TENDER SUBMISSIONS

A. Tender submission headings are required to follow the headings as noted below for ease of reference and scoring.

It will be a requirement of the Contract that the successful Tenderer shall comply with this Contract Document without any qualifications. Tenderers must, therefore present (in written form) any concerns they have at the mid-tender interviews and finally at tender submission. The tenderer is invited to visit the site and review it during the tender period in order to familiarise himself with the development. Tender submissions shall be in A4 and A3 format. Each Tenderer shall:

1. Provide a table of ALL Specification clause headings from this document. Against each clause heading confirm complying or clarification. Where issuing a clarification, state clearly the proposed deviation from the Specification. Any clauses not listed, the SFS is deemed to be complying. Any 'clarifications' or deviations from Specification not identified in this table shall be ignored and do not form part of the tender.
2. Return a full set of the relevant Employer's Representative's elevation, section and detail drawings marked up in colour indicating the Tenderer's understanding of his scope of work. Note, interfaces are deemed to be part of the Specialist Façade Subcontractor's work. Clearly indicate any work necessary for the full completion of the Works which has not been included for in his Tender, which will involve works to be carried out and costs to be incurred by others. Any such work not specifically described in the Tender return, shall be deemed to have been included for in the Tender. This includes secondary support-work and interfacing constructions.
3. Provide 1:5 project specific vertical and horizontal sectional details of the proposed typical stick system curtain walling including insulated back painted spandrel glazing. To include proposed perimeter extrusion details at all interfaces. Include details of support profiles and curtain wall construction. Include confirmation of proposal for transferring load from mullions.
4. Provide 1:5 project specific vertical and horizontal sectional details of the proposed rainscreen cladding including parapet interface construction.
5. Provide catalogue information of proposed doors.
6. Provide weather performance test certificates for louvres, curtain walling, point fixed glazing, doors, and opening vent systems where available. Where not available, confirm project specific testing will be carried out.
7. Provide cyclic test results for all door systems. Note all to be Heavy Duty type. Note, proposed ironmongery to be included in test report.
8. Provide confirmation that U values specified in Section 4.8 of this Specification will be achieved.
9. Provide details of proposed independent testing authority for materials and finishes testing and for weather performance testing.
10. Provide an outline program for the design, prototyping, testing, construction and installation of the Works.
11. Confirm Tenderer's ISO 9000 registration number and date of most recent audit.
12. Provide confirmation of the tenderer's proposed glass products for each part of the building with associated data sheets identifying G value, light transmission, internal and external reflectivity and thermal performance. Include confirmation of whether warm edge spacers are proposed.
13. Provide a schedule of warranty periods for each of the components contained in the Works (see Specified schedule).
14. Provide proof of Professional Indemnity Insurance stating insurance broker and policy terms, confirming sufficient cover for work in Ireland in line with Employer's Representative requirements.
15. Any submissions omitted from the tender return will be marked as zero. If the tenderer achieves the position of preferred bidder any missing submissions must be provided prior to contract signature.
16. Post tender, prior to contract signature the tenderer shall be required to agree with the Employer's Representative and Contractor, his precise scope of work and final Contract Specification as well as contract program. No further amendment or omission from the agreed scope and Contract Specification shall be permitted during the contract works without written acceptance from the Employer's Representative.

### 1.10 MANUFACTURERS

Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work to include but not to be limited to, the following:

Reynaers Ltd., 111 Hollymoor Way, Northfield, Birmingham B31 5HE, UK  
Tel +44 (0)121 4211999. Email: reynaersltd@reynaers.com. www.reynaers.co.uk

Boon Edam Ireland Ltd, Unit 1 Naas Road Business Park, Muirfield Drive, Dublin 12  
Tel: +353 (0)1 460 1410.

## SECTION 08 44 13

**PART 2 – PRODUCTS****FAC-010 – GLAZED CURTAIN WALLING SYSTEM**

Curtain walling is envisaged to be high performance stick system glazed and ventilated with integrated doors as per the design intent and as shown on the Design Concept and Design Intent Drawings. Product reference is Reynaers Aluminium Curtain Wall CW 50, thermally insulated aluminium add-on construction on a steel load-bearing structure (with brackets).

Tested and certified in accordance with the relevant EN and Centre for Window and Cladding Technology (CWCT) Curtain Wall Standards (tested and certified to the CWCT Standard Sequence B).

System to carry CE – Marking fully compliant with the EU Construction Products Directive (CPD) to the relevant product standard EN 14351-1 for windows and doors and EN 13830 for curtain walls. To be manufactured and supplied under the requirements of ISO 14001, the internationally accepted standard that outlines an effective environmental management system. To be manufactured and supplied under a quality system certified to EN ISO 9001: 2000.

Aluminium profiles shall be extruded from EN AW-6060 (AlMgSi0.5 F22) aluminium alloy to comply with EN 573 – parts 3 and 4.

Refer to the Design Intent Drawings for the full extent of the external Curtain Wall installation, to include all interfaces with adjoining different materials.

The installation shall include but not be limited to the following:

- Fixed lights.
- Double glazed curtain wall system incorporating fixed lights and operable lights which will incorporate look-alike insulated and back painted double glazed units, with backing insulation and vapour barrier insulated spandrel panels.
- Glazed aluminium external doors.

**PERFORMANCE:**

Refer to Part 4 of Section 08 44 13.

- System installed U-Value: 1.2 W/m<sup>2</sup>K
- Glass U-Value: 1.0 W/m<sup>2</sup>K (solar transmittance = 0.5 / solar factor GV = 24).
- Air permeability: 1.5 m<sup>3</sup>/h/m<sup>2</sup> (fixed lights), 2.0 m<sup>3</sup>/h/m<sup>2</sup> (opening lights).
- Wind load resistance: Up to 2000 Pa (class 5)\*.
- Water tightness: Up to 1200 Pa (class RE1200)\*.
- Acoustic performance: Rw (C;Ctr) = 33 (-1;-3) dB/ 60 (-2;-6) dB, depending on the glazing type.
- Certified Security Rating: **SR2 tested to LPS1175** including entrance door.

The installation shall include all firestopping and acoustic insulation at floor and partition interfaces. Fire stops shall include durable smoke and air seals. Acoustic and firestopping shall include mineral fibre insulation or sand-fill within mullion profiles in line with slab edge firestopping in accordance with the acoustic and fire engineer's guidance to achieve the required fire and acoustic flanking performance.

**SUPPORT STRUCTURE:**

The load-bearing structure of the façade construction is to be fabricated from steel supports supplied by secondary steel subcontractor.

The load-bearing structure of the façade construction consists of rectangular multi-chamber hollow profiles. The load-bearing profiles are located on the room side. All profile edges are rounded. The transom profiles are notched and overlap the mullions where they intersect, so that any moisture is reliably drained away. On multi-storey façades, all horizontal joints must be constructed using the joint connectors and joint tolerance seals belonging to the system. Appropriate system-based aluminium insert profiles and half profiles, as well as expansion joint seals, must be used for vertical expansion and assembly joints.

**DESIGN:**

The SFS shall coordinate the design and installation of the works with other subcontractors including structural and secondary steel, façade and cladding, roofing, specialist equipment such as revolving doors, etc.

The façade zone shall be determined by the Architectural intent. The SFS shall be required to engineer his system to fit within the zones provided.

The system curtain walling shall be stacked onto each floor in order to minimise load per floor. Incorporate all features on elevation as indicated on the Design Intent Drawings.

The system shall include strengthened profiles and specialist bracketry as required. Visible brackets shall not be permitted except where inserted into the rear surface of profiles.

**SYSTEM:****PROFILE DIMENSIONS:**

Profile face widths:

- Mullion, transom, cover caps: 50 mm

Profile basic depths:

- Mullions: 150 mm (nominal)
- Transoms: 150 mm (nominal)
- Cover caps: Rectangular, 20mm / 200mm (nominal)

GLAZING / INSERT UNITS:

Refer to thermal model for glass performance requirements (emissivity, safety, solar, g-value and energy factors). Provide full glass specification of the glazing unit including, spacer type and dimension, glass type, performance values, thickness and weight.

Reference glass type: Guardian Industries, Guardian Sunguard Extra Selective SNX 50/24.

Glass to be set against extruded EPDM rubber gaskets retained in undercut grooves within the aluminium profile and set on extruded glass support brackets.

Dry glazed and weather-stripping with EPDM extruded synthetic rubber gaskets to DIN 7863 and ISO 3934, set in undercut grooves in the mullion and transom.

Opaque insulated glazing spandrel panels (assumed insulated or double glazed to achieve look-alike appearance) to be included where indicated on the Design Intent Drawings.

Final colour to be selected from a range of sample assemblies (allow minimum 4 samples of proposed compositions). Liner to be provided to insulated spandrels, wrapping all insulation, to be formed from an aluminium backing tray hermetically sealed and bonded to the inner glass surface at the perimeter gasket interfaces.

Glass to the spandrel panels shall be back painted to the Employer's Representative's approval via samples. The paint coating shall be applied to face 2 or 4 to the insulated double glazed units.

DOORS:

Doors to be incorporated, with specialist profiles allowing integration into the curtain wall system while maintaining thermal performance lines and air seals.

Product reference: Reynaers Concept System CS 77 Insulated Door. Design variants as per design drawings.

Refer to the Door Schedule for operational details of each system glazed door.

- Air tightness max. test pressure: 4 (600 Pa)
- Water tightness: 7A (300 Pa)
- Wind load resistance: C2 (800 Pa)
- Acoustic performance:  $R_w$  (C; Ctr) = 42 (-1; -4) dB dB
- Thermal insulation ( $U_f$ ): 1.6 W/m<sup>2</sup>K (max.)
- Security: PAS24:2012 (UK Secured By Design Standard) and RC2/ WK2 (European standard EN(V)1627-EN(V)1630 (windows).

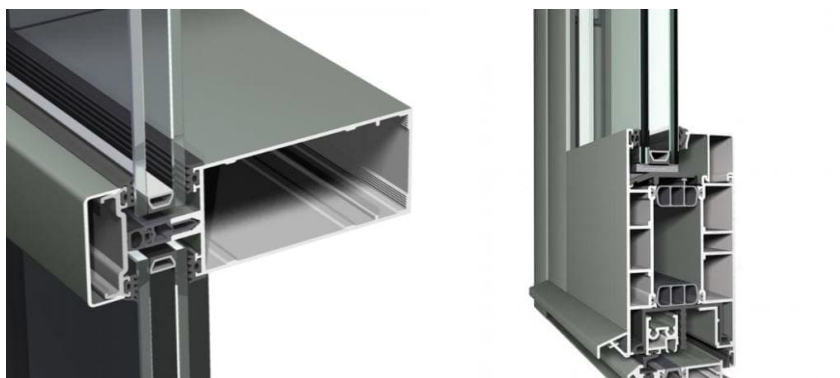
Control posts to be included for access control and operation of motorised doors (Internal and external): to be stainless steel posts with cut-outs to accommodate control panels provided by others. Wiring routes to be agreed and incorporated within frames.

VENTILATION:

Integrated ventilation and vapour pressure equalisation. Design to include appropriate openings in the aluminium pressure plates, cover caps and gaskets for field drainage and ventilation

FINISHES:

Polyester powder coated to 60  $\mu$ . RAL. Colour RAL 9010 (white) matt or as shown on design drawings.



INDICATIVE AESTHETIC REQUIRED

## SECTION 08 44 13

**PART 3 – TECHNICAL SCOPE OF WORKS****3.1 NATURE OF THIS SPECIFICATION**

This specification describes the technical requirements for the Works. For the full scope of the Works, refer to the Contract Documents. This is a performance based, document.  
To be read in conjunction with the Contract Documents and design intent drawings for clarity.

**3.2 DESIGN TEAM DOCUMENTATION**

Refer to:

1. Design Intent Drawings, and associated documentation.
2. Fire Engineer's report and Fire Cert drawings.
3. Structural drawings.
4. Structural Engineer's Design and Movement Report.
5. QS information and preliminaries.
6. M & E reports (free area calculations, thermal performance, solar control performance, internal conditions, control strategy etc.).
7. Contractor's instructions and survey information.

**3.3 DESIGN REQUIREMENTS**

Set out below are the requirements that the Specialist Façade Subcontractor shall follow when designing the Works. The Specialist Façade Subcontractor shall be responsible for ensuring he has obtained all approvals and carried out all calculations and design work required prior to ordering and manufacture in order to prevent abortive and/or non specification compliant work. All submissions shall be provided in the English language. Where test certificates have been provided to the Specialist Façade Subcontractor in another language, an official translation certified by the translating authority shall be provided to the Employer's Representative.

**3.3.1 GENERAL REQUIREMENTS**

1. All components within the Works shall be covered by a full replacement warranty period of not less than 10 years (including workmanship, coatings on glass elements and structural silicone seals).
2. The Specialist Façade Subcontractor shall be responsible for the design, provision and installation of all interfacing constructions required to provide an air, vapour and water seal to the building. This shall include, but is not limited to, not less than 300mm EPDM or foil faced bituthene vapour (minimum 0.7mm thick) and air barrier with associated supports. The EPDM/bituthene vapour barrier is to be on the warm side of all insulation and no condensation shall be permitted to form beyond this point. Note, this includes ALL interfaces.
4. Specialist façade subcontractors proposing to 'dress in' membranes provided by others shall be rejected.
5. Interfaces shall result in complex welded pressings being required to provide a fully weathered closure of the assembly. The Specialist Façade Subcontractor shall allow for site measuring and detailed resolution of these areas.
6. Materials that form, penetrate through and/or are outside the vapour barrier shall be non-ferrous. The use of pre-galvanised sheet thinner than 1.5mm in any areas shall not be permitted. All galvanising shall be external grade suitable for exposure to the external environment even where used internally (see Corus guidelines for external grade pre-galvanised sheet).
7. All materials shall be non-combustible.
8. All glass of a particular type shall be supplied from one manufacturer and from one batch in order to maintain continuity of colour, hue, and visual quality.  
Thickness of glass in any one screen shall be consistent based on the thickest glass calculated in order to maintain a uniform appearance. The Employer's Representative shall be the sole arbiter regarding acceptability of the above mentioned variations where they occur. The Specialist Façade Subcontractor shall ensure the glass supplier shall confirm that the proposed glass coating will be available for the following 5 years after practical completion.
8. Where an inner vapour barrier and outer weathering membrane are present in the same wall construction, the vapour barrier shall have a lower permeability than the outer membrane.
9. Where flexible or sheet vapour barriers/membranes are connected together or to other systems they shall be continuously sealed and positively clamped.  
Where fixed to the interfacing structure they shall be similarly continuously sealed and clamped.
10. Where flexible membranes are installed they shall be fully supported by aluminium trays or similar backing structure and shall not be permitted to span without support for more than 50mm. Membranes shall be detailed and installed in such a way as to discourage ponding.

11. Where insulation must be locally reduced in thickness, high performance insulation shall be provided to match the overall performance of the surrounding insulation. Thermal calculations shall take into account any reductions in insulation.
12. Site applied sealant shall not be acceptable as part of the primary sealing system unless shown on the Design Intent Drawings or noted within this specification.
13. All gaskets shall be accessible for inspection/replacement.
14. The air/ vapour barrier shall be designed to resist the full wind load.
15. Air tight Horizontal and vertical smoke fire stops/smoke seals shall be provided as required by the Building Regulations and in accordance with the consultant fire engineer's requirements closing between the cladding (glass line) and structure, including internal walls, providing not less than 60 minutes insulation and integrity. Refer to the Fire Certificate drawings and Consultant Fire Engineer's information for clarity. Note, firestopping shall be provided around all curtain walling preventing fire break-through into adjacent cavities.
16. Note, cavity barriers shall be required to extend to close to the back of all external rainscreen panels. Cavity barriers shall be certified IAB, BBA or BRE products. If certification is not currently available a written statement supporting the project specific use of the product from the IAB, BBA or BRE may be acceptable. In all cases the product must be installed in compliance with the Building Regulations Technical Guidance / Approved / Approved Documents. Heat treatment of glass shall be carried out where required in accordance with the requirements of this specification.
17. Wherever glass performs the role of a barrier, as defined in BS 6180, it shall be laminated safety glass class A.  
Note, manifestation shall be applied to glazing as required by the Building Regulations by the SFS (adhesive bonded type). Pattern and locations (in accordance with BS 8300 and APPROVED DOCUMENT Part M) may include the Client's Logo and shall be agreed with the Employer's Representative and the Client's Marketing Representative.
18. All fixings are to be hidden from view wherever possible. Any visible fixings are to be Allen-head type or turned 'pig-nose' type. External visible fixings, accessible at ground level shall be security type requiring special tools to remove them.
19. All insulation is to have Class O spread of flame rating.
20. No site grinding or welding of components shall be permitted.
21. Any slots in bracketry positioned in line with the direction of wind load or perpendicular to the cladding face shall be locked either by serrations or incorporation of a site drilled locking screw. Reliance on friction grip bolts shall not be permitted.
22. Company logos or names shall not be visible on the completed works.
23. The works shall incorporate all horizontal and vertical acoustic attenuation at floor slab edges where the cladding system seals to the slab edge and internal walls. This detail shall achieve the flanking transmission attenuation required by the Consulting Acoustic Engineer, not less than the figures specified herein.
24. All louvres intended to provide weather protection and allow transfer of air to shall be in accordance with the Consultant Engineer's specification single-bank Class A2 for water penetration and coefficient of discharge when tested in accordance with EN 13030 at 2.0m/sec face velocity or as agreed with the consulting mechanical engineer and Employer's Representative, ensuring provision of adequate prevention of water ingress into voids behind louvres. These shall be extruded aluminium type incorporating expanded aluminium bird mesh with a combined free area not less than that required by the Consulting Mechanical Engineer. In the design of louvre screens the Specialist Façade Subcontractor shall take into account the natural frequency of the louvres and ensure failure fatigue loading of fixings is prevented. Interfaces with mechanical plant shall incorporate connection details agreed with the mechanical contractor allowing drainage of all water that may enter the duct through the louvres. Refer to the Mechanical Engineer's documentation for air flow rate of air intakes.
25. Façade and secondary structure weights, deflections, point loadings into the primary structure and coordinated integration of structural movements and tolerances shall be submitted to the Project Structural Engineer as soon as possible after appointment for acceptance and agreement with other Works.
26. Motors for natural ventilation shall be integrated type, dual speed for silent operation. Motorised opening elements other than those in private offices shall be controllable by the BMS/fire-board. Motorised opening vents controlled by the BMS shall incorporate encoded motors. Where identified as smoke vents, the opening vents shall be certified and tested as such in accordance with EN 12101, shall have protected wiring such that they shall operate on signal from the BMS/fire board and shall remain in position in the event of power loss in accordance with the Fire Engineer's requirements. 24 hour battery back-up to be provided by the SFS adjacent to the smoke-vents.
27. The Specialist Façade Subcontractor shall employ the services of suitably qualified mechanical and electrical engineers to ensure the full control and management of the operating system is

fully agreed and coordinated with the Consulting Mechanical/Electrical Engineer. All motorised opening elements, including motorised entrance doors shall be designed to fail safe open upon signal from the building management system/fire board unless instructed by the Employer's Representative to operate otherwise. These employees shall be required to attend coordination meetings to ensure all parties are in full agreement regarding the split of services and components provided.

28. The Specialist Façade Subcontractor shall allow for provision of all secondary steel he requires that is not already indicated on the structural engineer's drawings as being part of the Primary Steel package. Should additional secondary steel support or bracketry be required, the Specialist Façade Subcontractor shall allow for these within his Works.
29. The Specialist Façade Subcontractor shall include provision of all internal aluminium pressings identified by the Employer's Representative at spandrel, at floor, ceiling, and wall interfaces. These shall be formed in minimum 2mm aluminium up to 300mm span or 3mm where larger, with slave joints and invisible fixings.

### 3.3.2 CURTAIN WALL GLAZING SYSTEMS

These systems shall:

1. Have full weather performance testing documentation for its proposed use prior to going into manufacture.
2. Be designed as dry glazed pressure equalised.
3. Incorporate a secondary drainage system behind the weathering seals, which drains to the outside.
4. Allow complete drainage of water from rebates to outside via mullion drainage.
5. Zone drained systems shall not be accepted.
6. Allow ventilation of the edges of the insulated glazed units, panes and panels.
7. Incorporate an internal air seal and vapour control layer that shall also act as second line of defence against water ingress (0.7mm EPDM on 2mm aluminium support).
8. Eliminate standing water on/or around the edge of insulated glazed units, panes and panels.
9. Provide the following when all tolerances are accommodated and the most onerous combination of movements occur (including wind sway):  
Sufficient edge cover on all insulated glazed units, panes and panels to maintain weathering and structural performance around their perimeter.  
Clearance to edges of all glass panes or panels of at least 2 mm everywhere around their perimeter
10. Incorporate isolation devices to minimise thermal bridging.
11. Be capable of being re-glazed from outside of the building.
12. Be sealed with gaskets at joints between mullions and transoms with a step in depth of drainage chamber to promote free drainage into the mullion in a stick system. Be sealed with gaskets at panel perimeters providing two lines of defence in all locations
13. Provide hidden mechanical retention to transom/mullion profiles and cover caps
14. At the bottom of each curtain wall provide notched mullion cut-out behind the mullion drainage ports allowing water to drain forward and below the EPDM top edge which shall run continuously fixed to transoms and behind the mullion drainage profile, providing a 100% air and water seal. Reliance on proprietary drainage spouts mounted in the mullion profile shall not be accepted.
15. At the top of each curtain wall incorporate sealant of the mullion drainage channels to provide continuous seal at the inner gasket line.
16. BMS controlled motorised opening vents shall be integrated into the system as required with hidden wiring and shall be designed to achieve the required free area defined by the Consulting Mechanical Engineer.
17. Include aerodynamic test reports for the size and operation of opening vents to provide the required aerodynamic free air supply specified by the Consultant Mechanical Engineers. Note, the curtain walling system supplier to provide written confirmation (project specific) to the Specialist Façade Subcontractor, confirming the required free area is achieved with the proposed vent size and opening.
18. Include firestopping and acoustic seals within mullions where they pass by a slab edge.
19. Include firestopping, smoke and acoustic seals between slab edge and the back of the curtain walling system where it passes the slab edge.
20. Include perimeter firestopping to prevent fire spread into adjacent cavities (30 minutes insulation and integrity minimum).
21. Mitre frames shall be project specific tested as per Clause 5.4 of this Document.

### 3.3.3 PRESSED METAL CLADDING SYSTEMS, RAINSCREENS AND INTERFACES

1. To include inner 2mm aluminium closer flashing supporting EPDM to provide a secondary weathering barrier. Insulation to be provided between the EPDM and outer parapet pressings.

2. Soffits to be similar construction to vertical panels, to include hidden fixings, hidden structural silicone bonded stiffening ribs, perimeter profiles and joints aligned with adjacent curtain walling. All to include associated EPDM air barriers where required (e.g. penetrations), bracketry, fixings, insulation and drainage systems. Insulation to be fixed to the structure, wrapping all beams.
3. Cavity closers at corners, copings and across the body of the façade at maximum 12m centres together with sufficient openings in the external face of the screen to allow external wind pressure to act on and pressure equalize the air in the screen cavity.
4. The facility to replace damaged or broken elements without removing more than 5 adjacent panels
5. Fully controlled drainage route for water from horizontal joints into vertical recessed profiles. Bracketry to incorporate thermal isolation.
6. Openings in the panels sufficient to ventilate the cavity, and allow water which may accumulate in the cavity to drain to the outside.
7. Protection from standing water to insulation at horizontal locations e.g. copings and roofs
8. Dark faced insulation where it will be visible. Insulation to be mechanically fixed with stainless steel, durable plastic or aluminium fixings. Reliance on adhesive shall not be permitted. Insulation to be external grade, certified by the insulation manufacturer as suitable for rainscreen cladding.
9. Fire and smoke cavity barriers (combined) as required by the Building Regulations and Consulting Fire Engineer extending across the cavity. Cavity barriers and their respective components to have a design life of not less than 35 years. To incorporate stainless steel restraint clips and fixings for durability. Cavity barriers to be installed such that the cavity is closed to within 20mm of the back of the external metal panel unless required otherwise by the consulting fire engineer or fire authorities. Include intumescent strip to close cavity in event of hot gasses entering the cavity.
10. Fire stops to be provided around all openings and vertical interfaces and at floor slab locations where required by the Building Regulations.
11. A continuous cavity tray in 0.7mm EPDM laid to falls, sealed to the supporting structure/vapour barrier, above cavity barriers and fire stops, soffit-to-wall interfaces and glazing opes, so that any water is drained to the outside.  
Interface locations to provide an outer weathering membrane and inner air seal membrane.
12. Anti-rattle/drumming features and anti-lift fixings to prevent wind driven or unlawful lift-off of the panels and to prevent drumming in heavy rain.
13. Full engineering calculations shall be required for each backing structure, panel type, bracket and fixing type taking into account maintenance loads, snow and wind loads. Note the backing structure shall be engineered to take the full design wind load uniformly and from point loads applied by the brackets from the outer skin.
14. Built-in features for over-flow and similar penetrations as required.
15. Incorporate pressed aluminium, welded collars for fitting of penetrations through the system maintaining all seals etc.
16. Include fully supported and bonded EPDM vapour and air barrier onto the backing structure.
17. To include expanded aluminium insect mesh at base details (minimum 0.7mm thick), closing between panels and insulation to prevent entry of vermin.

### 3.3.4 PRESSED METAL CLADDING SYSTEMS, INCLUDING PARAPETS, SOFFITS AND INTERFACES

These systems shall have:

1. Aluminium parapet coping panels shall be minimum 3mm thick with concealed fixings. Aluminium sheet to be stretched to minimise rolling tolerances. Note, rolling tolerances set by EN 485-4 shall not be acceptable. Tighter tolerances as specified shall be achieved. Stiffening angles (max 400mm centres) to be provided as required, structural adhesive bonded or stud welded to panel internal surfaces, to achieve the required panel surface flatness and Architectural aesthetic.
2. Include ALL parapets jointed to suit the curtain walling, 3mm aluminium, powder coated, with inverted welded top-hat drainage profiles and hidden fixings throughout. Welded end-caps to be included. To include inner 2mm aluminium closer flashing supporting EPDM to provide a secondary weathering barrier. Insulation to be provided between the EPDM and outer parapet pressings.
3. Soffits to be minimum 3mm thick aluminium, flat panels, to the Employer's Representative's selected colour via samples, to include hidden fixings, hidden structural silicone bonded or stud welded stiffening ribs, perimeter profiles and joints aligned with adjacent curtain walling setting out. All to include associated EPDM air barriers where required (e.g. penetrations), bracketry, fixings, insulation and drainage systems. Insulation to be fixed to the structure, wrapping all beams.

4. Cavity closers at corners, copings and across the body of the façade at minimum 12m centres together with sufficient openings in the external face of the screen to allow external wind pressure to act on and pressure equalise the air in the screen cavity.
5. The facility to replace damaged or broken elements without removing more than 5 adjacent panels
6. Fully controlled drainage route for water from horizontal joints into vertical recessed profiles. Bracketry to incorporate thermal isolation.
7. Openings in the panels sufficient to ventilate the cavity, and allow water which may accumulate in the cavity to drain to the outside.
8. Protection from standing water to insulation at horizontal locations e.g. copings and roofs
9. Dark faced insulation where it may be visible. Insulation to be mechanically fixed with stainless steel or aluminium fixings. Reliance on adhesive shall not be permitted. Insulation to be external grade, certified by the insulation manufacturer as suitable for rainscreen cladding.
10. Fire and smoke cavity barriers (combined) as required by the Building Regulations and Consulting Fire Engineer extending across the cavity. Cavity barriers and their respective components to have a design life of not less than 35 years. To incorporate stainless steel restraint clips and fixings for durability. Cavity barriers to be installed such that the cavity is closed to within 20mm of the back of the external metal panel unless required otherwise by the consulting fire engineer or fire authorities. Include intumescent strip to close cavity in event of hot gasses entering the cavity.
11. A continuous cavity tray in 0.7mm EPDM layer to fall, sealed to the supporting structure/vapour barrier, above cavity barriers and fire stops, soffit-to-wall interfaces and glazing opes, so that any water is drained to the outside.  
Interface locations to provide an outer weathering membrane and inner air seal membrane.
12. Anti-rattle/drumming features and anti-lift fixings to prevent wind driven or unlawful lift-off of the panels and to prevent drumming in heavy rain.
13. Full engineering calculations shall be required for each backing structure, panel type, bracket and fixing type taking into account maintenance loads, snow and wind loads.  
Note the backing structure shall be engineered to take the full design wind load uniformly and from point loads applied by the brackets from the outer skin.
14. Built-in features for over-flow and similar penetrations as required.
15. Incorporate pressed aluminium, welded collars for fitting of penetrations through the system maintaining all seals etc.
16. Include fully supported and bonded EPDM vapour and air barrier onto the backing structure.
17. To include expanded aluminium insect mesh at base details (minimum 0.7mm thick), closing between panels and insulation to prevent entry of vermin.

### 33.5 MANUALLY OPERATED DOORS

1. To be side hung (doors), opening to 90° inwards / outwards (refer to Design Intent Drawings). Stainless steel limiting devices with adjustable friction control are required and shall be capable of being undone only by authorized personnel. Door hinges to be colour matched pencil type to suit the door colour (block hinges shall be rejected).
2. Include extruded aluminium threshold incorporating weathering seals, small step and interfacing membrane to air seal to the building structure. Cill to door leaf seal to be EPDM gasket.
3. Shall not disengage from its supports under any of the relevant specified loads when open or closed
4. Shall not be capable of removal from the surrounding area of the cladding under any of the relevant specified loads, when closed.
5. To be provided with locking and security mechanisms in accordance with the Employer's Representative's and consulting mechanical engineer's requirements, and Contractor Cores with 2 No. keys for each lock. Additionally, all doors to be provided with suitable integrated (hidden stainless steel multi-point locking mechanisms. The Specialist Façade Subcontractor shall allow for all external door mortice locks to eventually be on the Employer's Representative's master keyed system. All doors shall be provided with temporary eurocylinder locks for construction stage. It is intended the final locks shall be fitted by others.
6. To be fitted with hidden intruder alarm sensors and wired for easy connection by others to the Building Management System.
7. To be fitted with integrated stainless steel door closers in all locations
8. Ironmongery and door locations/sizes shall be as specified by the Employer's Representative. All ironmongery to be stainless steel with anodized aluminium handles. Refer to Section 08 71 00 (Door Hardware).
9. Finishes and jointing shall be matching with the surrounding cladding as agreed with the Employer's Representative.
10. Incorporate two lines of continuous gasket as defence against water ingress, including stepped threshold at base.

11. Refer to the Employer's Representative's schedule for the requirements of each specific door
12. All doors to have reed switches integrated into frames hidden from view with associated wiring. Wiring to leave a tail minimum 2m long for connection by others.
13. Stainless steel overhead closer mechanisms shall be incorporated on all external doors. The spring strength class on all closers to be sized in accordance with the door dimensions and in accordance with the tested strengths in EN 1154. Refer to Section 08 71 00 (Door Hardware). All overhead closer mechanisms to be Cam action and incorporate a back check function, delayed action on closing and cushioned limiting stay functions. All closer mechanisms must be CE Marked, have Certifire certification and must be supplied with a Torque/ Force profile curve. At the tender stage the subcontractor needs to provide written confirmation from his specialist door manufacturer confirming their proposed design solution complies with all Building Regulation requirements, (current at the time of commencement on site) this specification, and manufacturers guidelines.
14. All manually operated doors unless specifically noted otherwise for functionality purposes, or if subject to fire escape routes, to be inward opening to prevent risk of wind damage to door or surrounding cladding or safety risk.
15. Should doors have to open outwards the hardware and connection detailing should be capable of withstanding wind speeds up to 17m/s (acting both as a sudden closing or opening force) as a minimum in the open condition.
16. Opening doors shall be designed to operate for their full design life (35 years) without dropping, flexing or deforming out of square. The opening elements and their supporting framework shall be designed to resist torsion loads induced by opening to prevent dropping of the free edge. Specialist subcontractor to provide details of maintenance required to achieve the durability and performance noted in this specification.
17. All ironmongery required to act as panic exit hardware is to be designed and tested in accordance with the requirements of EN 1125 – Building Hardware / Panic Exit Devices Operated by a Horizontal Bar/ Requirements and Test Methods. Vertical espagnolette rods to be hidden within door frames. Horizontal push-bars to be stainless steel.
18. High volume (entrance) insulated doors shall incorporate centre-style brush seals to allow either leaf to operate independently. They shall be individually lockable. Perimeter seals remain as rebated EPDM type.

### 3.3.6 MANUALLY OPERATED WINDOWS

1. To be opening to minimum 400mm clear opening, (refer to Design Intent Drawings and Consultant Mechanical Engineer's aerodynamic free area requirements). Stainless steel limiting devices with adjustable friction control are required and shall be capable of being undone only by authorized personnel. Limiting mechanism to be capable of holding the opening window against wind load (based on 5m/sec wind speed) in any position. Window hinges to be colour matched pencil type to suit the frame colour or hidden stainless steel friction stay type (to be identified at tender).
2. Where the window bottom transom is located 1.1m or less above internal floor finishes level it shall be restricted to 100mm opening by a mechanism capable of being un-done without specialist tools unless adequate guarding is provided internally to prevent risk of injury. Where guarding is required it shall be stainless steel tensioned rods and tubular stainless steel hand rail at maximum 100mm spacings, included in the Specialist Façade Subcontractor's package. Refer to the Consulting Mechanical Engineer's information for opening area requirements.
3. Shall not disengage from its supports under any of the relevant specified loads when open or closed
4. Shall not be capable of removal from the surrounding areas of the cladding under any of the relevant specified loads, when closed.
5. To be provided with locking and security mechanisms in accordance with the Employer's Representative's and consulting mechanical engineer's requirements, and with 2 No. keys for each lock. Additionally, all windows to be provided with suitable integrated (hidden) stainless steel multi-point locking mechanisms. The Specialist Façade Subcontractor shall allow for all external window locks to be on a master keyed system.
6. All windows to have reed switches integrated into frames hidden from view with associated wiring for connection by others to the Building Management System. Wiring to leave a tail minimum 2m long for connection by others.
7. Ironmongery and window locations shall be as specified by the Employer's Representative. Employer's Representative, all ironmongery to be stainless steel with aluminium handles.
8. Windows to naturally ventilated areas shall incorporate ability to provide permanent ventilation, in accordance with this Specification, the Building Regulations and Consultant Mechanical Engineer's requirements.
9. Finishes and jointing shall be matching with the surrounding cladding as agreed with the Employer's Representative.

10. Incorporate two lines of continuous gasket as defence against water ingress.
11. Inner gasket to be a continuous ring with moulded corners and vulcanized joints. Refer to the Employer's Representative's schedule for the requirements of each specific window.
12. Opening windows shall be designed to operate for their full design life (35 years) without dropping, flexing or deforming out of square. The opening elements and their supporting framework shall be designed to resist torsion loads induced by opening to prevent dropping of the free edge. Opening windows shall include provision of landing saddles to assist in closing but shall not rely on these for lifting the opening element into position. Specialist subcontractor to provide details of maintenance required to achieve the durability and performance noted in this specification.
13. To include multi-point locking operated by a single handle.  
Note, automated windows shall have similar performance characteristics except that opening shall be restricted to minimum 45° unless advised otherwise by the system supplier

### 3.3.7 MOTORISED DOORS

The Employer's Representative shall be made aware of the practicalities and functionality nuances associated with non-powered external doors. The Approved Document M of the UK Regulations referencing BS8300: 2009 states that 'a non-powered manually operated entrance door, fitted with a self-closing device capable of closing the door against wind forces and the resistance of draught seals, is unlikely to be openable by many people, particularly those who are wheelchair users or who have limited strength.'

It goes on to state 'a powered door opening and closing system, either manually controlled or automatically operated by sensors, is the most satisfactory solution for most people.'

MOTORISED DOORS SHALL:

1. Comply with all local and national Regulations including disability directives and associated guidelines.
2. Be provided with hardware and ironmongery elements, manufacturers and product names to be confirmed at tender stage, with a minimum full replacement warranty period of 12 years from date of practical completion. The subcontractor is to provide for and to identify a cost in his base submission for a fully serviced maintenance agreement with the Employer's Representative commencing from date of practical completion for 2, 5 and 10 years. Refer to Section 08 71 00 (Door Hardware).
3. Shall not disengage from its frame under any of the relevant specified loads when open or closed
4. Shall not be capable of removal from the surrounding areas of the cladding under any of the relevant specified loads, when closed.
5. Shall be provided with locking mechanisms in accordance with the Employer's Representative's requirements, and with 2 No. keys for each lock. The specialist Sub-Contractor shall allow for all external door mortice locks to be on a master keyed system.
6. Be fitted with hidden intruder alarms and wired for easy connection by others to the Building Management System.
7. Be tested for weather performance and durability as identified in this document (provide certificates)
8. All powered doors (all types) for pedestrian/ public use are to be designed in accordance with EN 16005: Powered pedestrian doors. Safety in use of power pedestrian doors.
9. Door leaf widths are to be minimised where possible and to not exceed 1200mm. Leaf heights also to be limited to 2550mm as maximum. Size limits must match tested ironmongery and motor limits.
10. All companies who install, and individuals who install, automatic door hardware must be full members of ADSA.
11. Opening doors shall be designed to operate for their full design life (35 years) without dropping, flexing or deforming out of square. The moving elements and their supporting framework shall be designed to resist torsion loads induced by opening to prevent dropping of the free edge. Specialist subcontractor to provide details of maintenance required to achieve the durability and performance noted in this specification.
12. Motorised doors shall have integrated/ hidden wiring. Installation of these elements includes individual commissioning and site testing to ensure full operation. Site testing to include not less than 20 cycles of opening and closing.
13. All motorised opening elements, including motorised entrance doors shall be designed to fail safe open upon signal from the building management system/fire board unless specifically programmed otherwise under the instruction of the Employer's Representative.

### 3.3.8 MOTORISED WINDOWS/ VENTS (IN ADDITION TO MANUAL OPERATED VENTS)

1. Be tested for weather performance and durability as identified in this document (provide certificates). Note multi-point locking system remains required in motorised vertical windows.

2. Refer to the Employer's Representative's door and window schedule for the requirements of each specific window.
3. Provide all motors and appropriately rated wiring to an agreed position (allow 10m from the nearest motor, to the MEP contractor's control box). All wiring inside frames to be provided in flexible conduit for ease of re-wiring in the future. The MEP contractor shall provide control boxes in agreed positions (assume individual control of each window). Control boxes and associated software shall include all components required for safe connection of mains power and BMS wiring to control the vents. The SFS shall ensure coordination of control language with the MEP contractor.
4. Outward opening windows to be provided with hardware, and connection detailing capable of withstanding wind speeds up to 17m/s (acting both as a sudden closing or opening force) as a minimum in the open condition. Vent areas are to be sized so as to allow the primary function under these wind speeds without risk or damage to users, the window itself and associated hardware/ironmongery and adjacent cladding.
5. Installation of these elements includes individual commissioning and site testing to ensure full operation. Site testing to include not less than 50 cycles of opening and closing. This package of work is to include encoded motors, aluminium cover boxes to actuators on aluminium framing.
6. Motors shall be integrated type, dual speed for silent operation (acoustic levels shall be demonstrated and agreed with off-site and on-site tests). Motorised opening elements shall be controllable by the BMS and separately, where required in the Employer's Representatives window and door schedule, to be locally controlled manually or motorised, again as required in the Employer's Representatives window and door schedule.
7. Motorised opening vents shall incorporate encoded motors. All wiring inside frames to be provided in flexible conduit for ease of re-wiring in the future or dedicated proprietary integrated wire way in the back of the system (add-on conduit shall not be accepted).
8. All cables for fire-rated and smoke related AOV's are to be fire-rated to BS6387, VDE 0266, FP200 (as required by the Fire Consultant to achieve the required protection) whilst all motors are to operate on a 24 Volt electrical supply. Where identified as smoke vents or fully automatic doors integral to the fire escape strategy, the opening vents shall have protected wiring such that they shall operate on signal from the BMS/fire board and shall remain in position in the event of power loss in accordance with the Fire Engineer's requirements.
9. All motorised opening elements, including motorised entrance doors shall be designed to fail safe open upon signal from the building management system/fire board unless specifically programmed otherwise under the instruction of the Employer's Representative.

### 3.4 TECHNICAL PROCEDURES

#### 3.4.1 SOURCES OF INFORMATION

The Specialist Façade Subcontractor's design, materials and workmanship shall comply with current standards and codes, except when their recommendations or requirements conflict with this Contract Document. If they do the Employer's Representative shall be notified and shall make a decision as to which documents takes precedence.

#### 3.4.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

##### STANDARDS

Aluminium extruded sections BS 1161, BS 1474, EN 515, EN 755

Aluminium plate, sheet and strip EN 485, EN 573

Anodising aluminium BS 3987

Anodising tests EN 12373-6, & -9

Barriers in and about buildings BS 6180

Bi-metallic corrosion PD 6484

Carbon steel angles EN 10056-1 and 2

Carbon steel beams joists and channels BS 4

Carbon steel bolts and nuts EN 24032, EN 24033, EN ISO 4034

Carbon steel hollow sections EN 10210

Carbon steel washers BS 4320

Continuously hot dipped zinc coating EN 10142, EN 10143, EN 10147

Doors/windows, weather performance EN 1026, EN 1027, EN 12211, EN 12207

Doors/windows, mechanical tests EN 12046-2, EN 1192, EN 12217, EN 947, EN 948, EN 949, EN 950

Doors/windows, cyclic tests EN 1191, EN 12400

Insulated glazed units EN 1279

Dynamic water test ENV 13050

Durability BS 7543  
 Fire BS 9999, BS 476: Parts 6, 7, 20-24  
 Gaskets BS 4255: Part 1  
 Glass BS 952, EN 572  
 Glazing for buildings BS 6262  
 Hot dip galvanising EN 1461  
 Hot rolled steel EN 10025  
 Impact performance of glass BS 6206  
 Laminated glass EN ISO 12543  
 Lightning protection BS 6651, BS 7430, BS 7671  
 Liquid organic coatings (pvf2) BS 4842  
 Loading for buildings BS 6399: Parts 1, 2 & 3  
 Non-load-bearing vertical enclosures BS 8200  
 Polyester powder coating on aluminium BS 6496  
 Quality assurance systems EN ISO 9001  
 Pre-cast concrete BS 8297  
 Protective coating of iron & steel structures against corrosion EN ISO 12944: Parts 1-8  
 Rain gauges BS 7843-3  
 Sampling procedures BS 6001-1  
 Sealants (non-structural) BS 6213, EN ISO 11600  
 Sills and copings BS 5642: Parts 1 & 2  
 Slip resistance BS 8204  
 Sound insulation and measurement BS 5821, EN ISO 140-3 & -5, EN ISO 717-1, EN 20149  
 Stainless steel EN 10029, EN 10048, EN 10088, EN 10258, EN 10259  
 Steel plate, sheet and strip EN 10021, BS 1449: Part 1.1  
 Steel preparation BS 7079: Part A.1  
 Steel tubes EN 6323: Parts 1, 2 & 3  
 Structural fixings in concrete BS 5080: Parts 1 & 2  
 Structural sealant Pr EN 13022-2  
 Structural use of aluminium BS 8118  
 Structural use of steel BS 5950  
 Stainless steel fasteners EN ISO 3506-1 & -2  
 Testing of aluminium welds EN 895, EN 910, EN 1320, EN 1321, BS 3451  
 Testing of welders EN 287-1 & -2  
 Welding consumables EN 440, EN 499, EN 756, EN 758, EN 1600, EN 12072  
 Welding of stainless steel BS 7475  
 Welding procedures EN 288, EN 1011-1, -3 & -4, BS 5135  
 Welding procedures testing EN 288-3 & -4  
 Window safety BS 8213: Part 1  
 Workmanship on building sites BS 8000: Parts 7 & 16  
 Zinc rich paints BS 4652  
 Code of Practice for the use of rope access methods for industrial purposes BS 7985:2002  
 Powered pedestrian doors. Safety in use of power pedestrian doors. Requirements and test methods EN 16005

### 3.4.3 OTHER NATIONAL STANDARDS

Heat soak testing of toughened glass EN 14179-1 & 2  
 High performance organic coatings AAMA 2604, AAMA 2605  
 Elastomeric cellular pre-formed gaskets ASTM C 509  
 Test method for dry film thickness ASTM D 1400  
 Australian Standard AS 1288 - 1994

### 3.4.4 LOCAL AND NATIONAL BUILDING CODES

The 2010 Building Regulations.

### 3.4.5 GUIDES, REPORTS AND CODES OF PRACTICE

American Welding Society Recommended practices for stud welding.  
 BCSA & SCI National Structural Steelwork Specification for Building Construction 3rd Edition.  
 Irish/British Board of Agrément Methods of assessment and testing.  
 BSRIA  
 Technical Memorandum TN10/98-  
 Air leakage of office buildings.  
 Building Research Establishment Information Paper 2/82 Ergonomic requirements for windows and doors.

Centre for Window and Cladding Guide to the design of thermally improved glazing frames.  
Standard and guide to good practice for curtain walling.  
Standard for Walls with Ventilated Rainscreens.  
Standard for Systemised Building Envelopes.  
Technical Notes.  
CIRIA Book B5-Rainscreen cladding: A guide to design principles and practice.  
Special publication 87-Wall Technology.  
Technical note 107-Design for Movement in buildings.  
Council for Aluminium in Buildings A guide for thermal assessment of aluminium windows.  
A guide for thermal assessment of aluminium curtain walls.  
European Organisation for Technical Approvals  
Document 002; Structural sealant glazing systems.  
J.M. Davies, Lightweight Sandwich Construction.  
N. Cook, The designer's guide to wind loading of building structures.  
Secretary of State Process guidance note PG6/23.  
The Steel Construction Institute Concise guide to the structural design of stainless steel SCI 123.  
Design of stainless steel fixings and ancillary components SCI 119.  
Curtain wall connections to steel frames SCIP 101.  
Employer's Representatives Guide to Stainless Steel SCIP 179.  
Industrial Rope Access Trade  
Association ([www.irata.org](http://www.irata.org))  
Guidelines on the use of rope access methods for industrial purposes (and other publications)

## SECTION 08 44 13

**PART 4 – PERFORMANCE REQUIREMENTS**

## 4.1 PRINCIPLES OF DESIGN INTENT

## 4.1.1 THE BUILDING

The building is required to provide safe, dry, temperate and comfortable conditions under all extremes of weather that can be reasonably anticipated. Its walls and roofs are expected to withstand the deleterious and degrading effects of radiation from the sun, weathering, atmospheric pollution, vandalism, vermin, fungi and other growths for the required service life described herein without maintenance in excess of routine cleaning and minor repairs.

## 4.1.2 THE WORKS

The Works shall withstand or accommodate the stresses and movements induced by changes in temperature, building settlement and other physical and chemical changes. It shall have a resistance to combustion and fire spread appropriate to each part and shall prevent casual and unlawful entry into the building. It must be possible to clean and maintain the Works easily without interfering with the function of the building.

The Works are required to include suitable allowances for construction tolerances, cambers, estimated deflections, relative deflections and the long term movements associated with the settlement of the foundations, or any other movements of the structure.

It is the responsibility of the Specialist Façade Subcontractor to ensure he is fully informed regarding the structural behaviour of the building.

The Specialist Façade Subcontractor shall ensure that he has allowed for all hardware, brackets, channel fixings, trims, and all components necessary for the full and complete finishing of the works, not necessarily shown on the drawings or described in this the specification prepared for the works. He will be responsible for obtaining the necessary approvals from the Statutory Authorities.

From the 1st July 2013 CE Marking of construction products is mandatory under the Construction Products Regulation (CPR) 2013. The Declaration of Performance (DoP) is the key concept in the Construction Products Regulation (CPR). The DoP serves to deliver the information about the essential characteristics of the product that a manufacturer wants to make available on the market. All products provided by the SFS are to be CE Marked and have a DoP.

The SFS will maintain a record of Declarations of Performance (DoP) of all installed products and materials for inclusion in the Building Operations and Maintenance Manual.

## 4.2 GENERAL PRINCIPLES OF PERFORMANCE FOR THE WORKS

The Works shall perform at the levels set out herein as a minimum.

## 4.3 DESIGN LIFE

The design life of the building shall be as BS ISO 15686: Part 1, Table 1, 25 years and with BS 7543 category 2 maintenance level. This requires maintenance work carried out to a pre-determined interval of time, number of operations, at regular cycles to be determined by the SFS. Within that period, the assembly shall perform at or exceed the performance levels specified throughout this document, without maintenance in excess of routine cleaning, lubrication and minor repairs.

The building falls within the 'marine' category (EN ISO 9223:2012 Corrosion of metals and alloys - corrosivity of atmospheres - classification, determination and estimation (2012)). Materials and components which under normal service conditions cannot meet the specified service life, i.e. 'replaceable elements', as defined in BS 7543, shall be identified Employer's Representative. Details shall be provided together with methods of replacement, in accordance with the Schedule of Submissions.

Materials and components that under normal service conditions will meet the service life of the cladding without loss of performance below those specified in this specification, but require servicing and maintenance to do so, i.e. 'maintainable items', as defined in BS7543, shall be identified by the Specialist Façade Subcontractor. He shall provide comprehensive recommendations for the servicing and maintenance of them in accordance with the Schedule of Submissions.

All structural fixings, frames, brackets, angles, or other load bearing components shall remain in position and meet structural stresses and loadings for a period in excess of the required service life without maintenance or replacement. These are 'lifelong elements' as defined in BS 7543.

#### 4.4 WARRANTIES/GUARANTEES/INSURANCE

The Specialist Façade Subcontractor shall provide evidence of Professional Indemnity Insurance and Collateral Warranty as requested by the Employer's Representative. PI insurance to be not less than €10,000,000 on an each and every basis for a period of not less than 10 years from date of practical completion. For the purposes of this document, 'warranties' and 'guarantees' are understood to be interchangeable terms. Warranties from the Specialist Façade Subcontractor are required for the system and its components. Additional warranties or letters of certification, in writing, are also required from principal material suppliers, confirming that their materials are being used and installed in such a manner that the requirements of the Contract Documents are met.

The Specialist Façade Subcontractor shall provide the information in the form of a table with headings as below, in accordance with the Schedule of Submissions and Tender Submissions requirements.

This specification and any guarantees required shall be construed and interpreted in accordance with UK Law and shall be subject to the UK Courts only.

Where reference is made in this specification or guarantee to any EN, British Standard, Board of Agreement Certificate or Code of Practice, it shall be construed as reference to such publication in the form in which it is in force at the date of the specification.

The Specialist Façade Subcontractor shall provide a guarantee with the Maintenance Manual to replace any part of system which fails in material or workmanship. Failure of materials or workmanship includes but is not limited to, excessive water leakage or air infiltration, excessive deflections, interstitial condensation, faulty operation, delamination of laminated elements, adhesive or cohesive bond failure, deterioration or discolouration of finish in excess of normal previously identified and agreed weathering, and defects in hardware, weather stripping, and other components and loss of hermetic seals. Each guarantee/warranty shall take into account the surrounding external environment as described in EN 12944-2.

The Specialist Façade Subcontractor shall provide a guarantee with the Maintenance Manual to cover the costs of access, dismantling, removing, making new parts, making good to adjacent/ surrounding surfaces, finishing and re-fixing to match existing.

Insulating glass: The Specialist Façade Subcontractor shall submit two copies of written guarantee with the Maintenance Manual, agreeing to replace (including access, fixing and making good) insulating glass units which fail to maintain a hermetic seal of the air space, glass breakage (including spontaneous breakage due to NiS inclusions in excess of 1 breakage per 400 tonnes of glass) or which show deterioration of coatings or colours (if any) or which lose heat-exclusion ratings, or deteriorate in any other manner, due to failure of materials or workmanship, within 10 years of date of Practical Completion of the Sub-Contract Works. Note, units that have dessicant visible in the cavity between glass lights are deemed to have failed as this should not occur.

Guarantees will be treated as not requiring any maintenance or inspection unless such are specification described in the maintenance manual. The Employer's Representatives must be informed in writing of any aspect of the construction which may not meet this requirement and his specific approval granted for any relaxation.

Structural fixings, frames or support components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 60 years without maintenance or inspection. These are lifelong elements as defined in BS 7543.

##### 4.4.1 COPYRIGHT OWNERSHIP

The Employer's Representative retains copyright for the outline design of the building. The Specialist Façade Subcontractor shall indemnify and hold harmless the Employer's Representative and Design Team against all liabilities, losses, costs and expenses which the Employer's Representative and/or Design Team may suffer if the designs provided by the Specialist Façade Subcontractor or any of the Documents infringe any letters patent, trade mark or any other rights of a third-party protected by law.

#### 4.5 APPLIED LOADS

##### 4.5.1 GENERAL

The Works shall transmit the design loads as specified below to the building structure via the points of attachment as designed and built, with an adequate margin of safety appropriate to each material and product. As required by the appropriate Codes of Practice, the various load cases and combinations of load cases acting together shall be considered.

#### 4.5.2 GRAVITY

The Works shall support its self-weight and transmit this weight safely back to the supporting structure without overloading or permanently displacing any of its components.

#### 4.5.3 WIND

The building is located in a location susceptible to high winds. The Specialist Façade Subcontractor shall calculate the wind loads to be carried by the Works INCLUDING DOORS taking into account funnelling and other site-specific environmental conditions.

He shall submit preliminary calculations with his tender and detailed calculations for review by the Employer's Representative, as soon as possible after award of contract. The Works shall support these wind loads and transmit them safely back to the supporting structure without overloading or permanently deforming any of its components.

The Specialist Façade Subcontractor shall calculate the actual wind loads taking into account applicable external, internal and local pressure coefficients. He shall submit preliminary wind load calculations with his tender and detailed calculations for review by the Employer's Representative, as soon as possible after contract award, prior to going into manufacture of the Works. Calculations shall be carried out in accordance with EN1991 by a suitably qualified chartered structural engineer. Structural calculations shall be completed, submitted and signed off prior to manufacture. All, canopies, cantilevered elements and screens subject to external conditions from both sides are to be engineered in accordance with EN 1991 (with appropriate annex). Deflection limit at the top of any cantilever panel shall not exceed  $L/180$  or 15mm whichever is the lesser when subjected to the worst case loading.

#### 4.5.4 WIND RESISTANCE: SAFETY

When tested at both positive and negative applications of the design wind loads, multiplied by a factor of 1.5, there shall be no permanent damage to framing members' panels or anchors. Framing members shall not be buckled. Panels, glazing beads, structural silicone assemblies and decorative capping pieces shall remain securely held and gaskets shall not be displaced. Opening vents shall remain closed and shall not be disengaged from their frames.

Permanent deformation to framing members shall not exceed  $1/500$  of the span measured between points of attachment to the structure after loading.

#### 4.5.5 IMPACT

The Works shall satisfy the requirements of CWCT TN52 ref Tables 3 and 4 of BS Table 2. The maximum visually acceptable dent in a metal surface when subjected to the test load is 10mm in diameter and 3mm in depth.

#### 4.5.6 ACCIDENTAL LOADING

The Works shall sustain safely and without damage, a static load of 500 N applied horizontally through a square of 100mm side on any part of the framework, glass, or surface metalwork.

#### 4.5.7 CROWDS

The Cladding shall be designed to sustain safely each of the following static horizontal loads (derived from BS6180:2011) acting separately:

Minimum: 1.5 kN/m for all areas acting at a height of 1.1 m above finished floor level, and a uniformly distributed load of 1.5 kN/m<sup>2</sup> and a point load of 1.5kN acting on any part, up to and including 1.1 m above finished floor level.

Note: assemblies where glass is retained on point fixings and are required to achieve the loadings noted above shall be tested physically to demonstrate compliance with the requirements. Structural calculations shall be required in addition to the testing.

#### 4.5.8 ACCESS AND MAINTENANCE

Any gutters, parapets or flat and near flat surfaces, including glass, in the Works may be used for maintenance and occasional access by design or not, and therefore shall sustain safely and without damage each of the following loads.

A uniformly distributed load of 0.9 kN/m<sup>2</sup>, and a concentrated load of 1.2kN acting on a 125 mm x 125 mm square contact area applied repeatedly anywhere on the finished surface, applied separately. Note, this loading capacity is required in all areas whether they are intended for access or not.

#### 4.5.9 SNOW / ICE

The Works shall sustain any loads created by snow and/or ice and shall transmit these loads back to the supporting structure safely without overloading or permanently deforming any of its components. Snow load shall be calculated in accordance with EN 1991. Calculations for review by the Employer's Representative shall be provided in accordance with the Schedule of Submissions.

#### 4.5.10 INTERNAL LOADS ON INSULATING GLASS UNITS

The building is at an altitude of less than 100m above sea level. The combined effects of temperature, altitude, atmospheric pressure, together with the other specified loads, shall be considered in the design of insulating glass units.

#### 4.5.11 TEMPORARY CONDITIONS

The Works shall sustain any temporary loading that may arise from lifting, storing, transporting, hoisting and installing them, or any other works, which will induce stresses greater than those which will be induced when the Works are completed.

The Specialist Façade Subcontractor shall submit design calculations for review by the Employer's Representative showing that these requirements have been met.

### 4.6 MOVEMENT AND DEFLECTION

#### 4.6.1 ACCOMMODATION OF MOVEMENT GENERALLY

The Works shall accommodate the movements noted below without any reduction in the performance below the minimum levels required herein.

1. Deflections due to design dead loads and live loads.
2. Deflections under repeated cycles of the design wind loads.
3. Changes in dimension and shape arising from building movements, including settlement, shrinkage, elastic shortening, floor beam deflections, creep, wind sway, twisting and racking and thermal and moisture movement.
4. Due to movement of any joint in the supporting structure or building frame.

The Specialist Façade Subcontractor shall provide estimates of nominal, minimum and maximum joint widths accounting for tolerances and movements at all movement joints and shall confirm to the Employer's Representative that the joints shown on the Design Drawings will accommodate them.

#### 4.6.2 ACCOMMODATION OF BUILDING MOVEMENT

The Works shall accommodate the following movements without any reduction in the performance below the minimum levels required herein.

1. Sway of the building.
2. Reduction in storey height under live loading.
3. Reduction in storey height due to creep.
4. Differential settlement of one foundation relative to the next one.
5. Differential beam deflection between adjacent floors due to imposed load on one floor only.
6. Differential beam deflection between adjacent floors due to creep.
7. Differential structural movement at designated movement joints.

The works shall accommodate the movements as specified in the Structural Engineer's documentation without any reduction in the performance below the minimum levels specified herein. It is the responsibility of the cladding Specialist Façade Subcontractor to ensure he obtains all information required from the consultant structural engineer to complete his design.

#### 4.6.3 CLADDING DEFLECTION LIMITS

Under the action of the most onerous combination of loads, deflections of framing members shall not exceed the values given below. The deflection shall be recovered fully when the loads are removed:

Framing members generally - at both positive and negative applications of the peak out of plane load, the maximum horizontal deflection shall not exceed 1/200 of the span of the member measured between points of attachment to the building, or 15mm, whichever is the lesser.

Framing members supporting single glazing - at both positive and negative applications of the peak out of plane load, the maximum horizontal deflection shall not exceed 1/125 of the length measured along the pane edge or 15mm, whichever is the lesser.

Framing members supporting vertical insulated glazing units - at both positive and negative applications of the peak out of plane load, the maximum horizontal deflection shall not exceed 1/175 of the length measured along the unit edge, or 15 mm, whichever is the lesser, or more restrictive limits if set by the unit manufacturer.

Panels (metal and glass) generally - at both positive and negative applications of the peak out of plane load, the maximum horizontal deflection shall not exceed 1/350 of the longest span of the panel measured between points of attachment to the building/framing, or 15mm, whichever is the lesser.

The downward vertical deflection of framing members that support the weight of glazed panels or other elements shall not exceed 1/500 of the length measured along the glass edge or 3mm, whichever is the lesser. This includes all glazing.

The horizontal deflection of louvres shall not exceed 1/400 or 10mm, whichever is the lesser when subjected to both positive and negative applications of the peak out of plane load.

The horizontal deflection cantilever structures at application of the maximum calculated load shall not exceed 1/400 or 10mm, whichever is the lesser when subjected to both positive and negative applications of the peak out of plane load.

Refer to section 5.0 for test method.

#### 4.6.4 ACCOMMODATION OF THERMAL MOVEMENT

The Works shall accommodate changes in dimension resulting from changes in temperature in any of its parts, its supporting framework and bracketry without any reduction in the performance below the minimum levels required herein.

The surface temperature ranges shall be calculated and shall be taken as being not less than the following:

External surface temperatures:

Heavyweight materials, light colour: -20°C to +50°C

Heavyweight materials, dark colour: -20°C to +65°C

Lightweight insulated materials, light colour: -25°C to +60°C

Lightweight insulated materials, dark colour: -25°C to +80°C

Clear glass -25°C to +50°C

Coloured and high performance glass -25°C to +90°C

Metal panels shall be designed to withstand the calculated temperatures and to remain within deflection tolerances identified in 4.6.3 above. In particular the Specialist Façade Subcontractor shall ensure the appropriate laminant is used for all areas and that the laminant retains its structural integrity at the predicted service temperatures.

#### 4.6.5 ACCOMMODATION OF MOISTURE MOVEMENT

The Works shall accommodate the following movements without any reduction in the specified performance:

1. Due to changes in the moisture content of its components, and wetting due to rain.
2. Expansion of absorbed or retained moisture due to freezing.
3. Due to changes in the moisture content of the supporting structure and interfacing construction.

#### 4.7 WEATHERTIGHTNESS

##### 4.7.1 INTERFACING CONSTRUCTION

The weathering principles incorporated within the Works and interfacing with adjacent elements of work shall be compatible with the weathering principles adopted by the adjacent elements of work. It is the responsibility of the glazing Specialist Façade Subcontractor to coordinate his work with adjacent trades, with the assistance of the Contractor, to ensure the provision of a durable weather-proof interface incorporating a minimum of two lines of defence and insulation. The design life of interfaces shall be similar to surrounding works.

The glazing Specialist Façade Subcontractor shall be the lead cladding Specialist Façade Subcontractor and shall coordinate his works with interfacing following trades while providing a fully sealed, insulated and durable closure to the primary structure or interfacing weathering system ensuring it is fully air sealed with a minimum of two lines of defence against air and water ingress. To this end, the glazing Specialist Façade Subcontractor shall provide minimum 300mm collar of 0.7mm thick EPDM clamped and sealed to the interfacing construction around all openings. Reliance on provision by others of membranes sealing to the window/curtain-wall frame shall not be accepted.

The Specialist Façade Subcontractor shall be responsible for coordinating and agreeing compatibility of all interfacing details and ensuring the correct combination of materials are used.

#### 4.7.2 AIR PERMEABILITY

The Works shall be required to limit air flow, from the exterior surface to the interior surface through any of its joints, to the air leakage rates specified below, when it is subjected to wind induced pressures or suctions across the cladding:

An overall building Airtightness Performance of  $5.0 \text{ m}^3/\text{hr}/\text{m}^2$  at 50 Pa to be achieved. This is to be the minimum Air Tightness Performance to be achieved.

There shall be no region of concentrated air flow through the Works as a whole or at any interfaces.

#### 4.7.3 WATER PENETRATION RESISTANCE

The Works including all joints between it and other elements of work, shall effectively prevent leakage of water into the interior of the building from the outer face of the assembly, under the action of wind pressure kinetic energy, gravity surface tension, or capillary action. It shall also prevent water entering into those parts of the cladding that would be adversely affected by the presence of water.

All joints within the Works shall maintain their water tightness under the loads and movements specified herein.

The drainage of water along edge seals of insulated glazed units is not permitted unless written confirmation is provided by the unit manufacturer stating that the design life, required service life and warranty, of the unit is unaffected.

#### 4.7.4 RAINWATER DISPOSAL

The Works shall accommodate the anticipated rainfall with sufficient numbers of outlets to allow for outlet blockage between maintenance inspections. The design shall allow for the provision of visible warning pipes and overflow outlets for all concealed gutters. The Specialist Façade Subcontractor shall allow for integration of overflow outlets through the cladding from roof areas where indicated on the Design Intent Drawings.

#### 4.8 THERMAL PERFORMANCE

Thermal performance to be as confirmed by the Employer's Representative.

To achieve the required performance, the SFS shall be required to select a curtain walling system with extremely good thermal performance through frames. Detailed analysis should be carried out at Tender to ensure the correct system is proposed so as to avoid abortive work later.

Data shall be submitted at Tender confirming that the Works meet the required performance. Detailed calculations prepared by the Specialist Façade Subcontractor incorporating edge effects and frame effects, shall be submitted to the Employer's Representative for review during the design development stage.

##### 4.8.1 ASSESSING THERMAL PERFORMANCE, CALCULATION

The heat transferred through windows, curtain walls and other thermally complex glazing shall be assessed by 2 dimensional numerical analysis. The software shall be validated against benchmarks in line with CWCT and SEI guidelines. The results of the assessment shall be summarised as thermal transmittance (U values) for the central and perimeter zone of each relevant cladding type. Overall U values for each relevant cladding type shall be calculated as a weighted average of constituent areas, with the weighting method defined.

The calculation method shall take into account the internal and external surface heat transfer resistances. These resistances and the parameters which affect them shall be quoted. The method shall take into account the effects of any air spaces, porous materials, and the thermal interaction between elements of the Façade. Guidelines for the calculation method are laid out in the CWCT Guide to the Design of Thermally Improved Glazing Frames.

##### 4.8.2 SOLAR CONTROL

Body tinted glass shall not be accepted.

Coatings, in combination with the glass to which they are adhered, shall be uniform in appearance. Where there is a dispute, measurements shall be carried out at the SFS cost using a portable sphere spectrophotometer (X-Rite SP62 or similar). The Employer's Representative shall select the areas for measurement. Measurements shall be captured in  $L^*a^*b^*$  colour values. Delta values shall be ascertained measuring between the 'reference' panel location and the target location. The difference between locations shall be represented as a Delta value for each of the  $L^*a^*b^*$  colour values shall be maximum 1.5.

Measurement shall be carried out in accordance with the European Association of Glass Manufacturers 'Code of practice for in-situ measurement and evaluation of the colour of coated glass used in façade' and EN 1096-1.

Solar control data shall be submitted to the Consultant Mechanical Engineer confirming that the proposed glazing will meet the required performance noted below:

FLAT GLASS

All elevations:

Low iron (maximum 0.015% iron content) glass to be used on all non-coated glass:

Visible light transmission min 39%

External visible light reflectance 20% (max).

Internal visible light reflectance 26% (max)

Total Solar Energy Transmission (solar factor, EN410) 0.19 Ug (centre pane U value, target) 0.5 W/m<sup>2</sup>K

NOTE 1: Glass to have mirror or NEUTRAL grey/blue colouring with minimal effect on colour of light entering the space. In all cases the Colour Index RD65 shall not be lower than 85.

It is understood that the high performance glass noted above would have a long lead time.

Therefore, the Specialist Façade Subcontractor is required to urgently confirm his proposed glass type and to submit the samples noted in this specification as soon as possible after contract award. It is the Specialist Façade Subcontractor's responsibility to ensure his selected glass achieves all of the performance criteria required by the contract documents.

#### 4.8.3 CONDENSATION

The Works shall include thermal breaks.

Condensation shall not form on or behind the building side of the vapour barrier, or on surfaces or in areas which compromise the performance of the Works.

The Specialist Façade Subcontractor shall assess the risk of surface or interstitial condensation forming, based on the worst case environmental conditions as specified below. The Specialist Façade Subcontractor shall confirm these values with the Mechanical Engineer prior to carrying out his calculations. Dew-point calculations prepared by the Specialist Façade Subcontractor shall be submitted to the Employer's Representative for review.

Note, the figures shown below are approximately based on calculations for mechanical plant design. The cladding contractor is required to submit his own calculations, based on local environmental conditions. Information shall be obtained by the Specialist Façade Subcontractor from the Meteorological Office and consulting Mechanical Engineers.

External conditions:

As specified by the consulting mechanical engineer.

Internal conditions:

As specified by the consulting mechanical engineer.

Refer to the consulting mechanical engineer's documentation for further detail regarding predicted humidity and operating temperatures.

Note, the building is not humidity controlled.

The Specialist Façade Subcontractor shall provide calculations indicating where condensation is likely to form in the systems the Specialist Façade Subcontractor proposes. The Specialist Façade Subcontractor shall design his systems to ensure no condensation shall form on the room side of the vapour barrier.

Particular attention is required to prevent condensation forming inside the building where any support members protrude through the vapour barrier.

#### 4.9 ACOUSTIC PERFORMANCE

The Specialist Façade Subcontractor shall take into account the Employer's Representative's acoustic performance requirements and shall ensure the proposed façade attenuates sound intrusion to allow compliance with the requirements of this Specification.

##### 4.9.1 AIRBORNE AND STRUCTURE BORNE SOUND INSULATION

The Works, including sealing to other elements of work and around primary fixings, shall provide airborne sound reduction of not less than those required to achieve acceptable resultant internal noise as defined by the Employer's Representative's Consulting Acoustic Engineer.

Criteria specified by the Employer's Representative's Consulting Acoustic Engineer for airborne sound attenuation and flanking values to be confirmed by the Specialist Façade Subcontractor's Consulting Acoustic Engineer and system supplier:

Octive Band Centre Frequency (Hz)

Area 63Hz 125Hz 250Hz 500Hz 1k 2k 4k

Outside to inside (general): X

Figure 'X' to be as specified by the consulting Acoustic Engineer to achieve acceptable noise levels within the building.

FLANKING TRANSMISSION:

Floor to floor flanking transmission: The system shall provide a weighted standardised flanking level difference of at least DnTf, w 50 dB

Room to Room flanking transmission (see plan locations): The system shall provide a weighted standardised flanking level difference of at least  $DnTf, w$  45 dB (measured laterally through mullions where applicable).

#### 4.9.2 DEMONSTRATION OF ACOUSTIC PERFORMANCE

The Specialist Façade Subcontractor shall provide, testing and/or certification from his independent acoustic consultant confirming his proposed cladding construction including mullion penetrations at floor slab locations shall meet the acoustic performance figures quoted in this document for outside/void to inside transmission and flanking transmission.

The Specialist Façade Subcontractor shall take into account that on-site acoustic testing may be carried out by the Employer's Representative and if the installed system is found to be defective it shall be remedied at the SFS's cost with no extension of time.

#### 4.9.3 PARTITION ABATEMENT

The external curtain wall Works shall be able to accommodate simple airtight seals to partitions where applicable, to limit acoustic flanking transmission. This shall be achieved both for partitions that butt onto the back of mullions and for partitions that continue over either side of the mullion, without displaying board edges to the exterior (features to be incorporated into frame design).

#### 4.9.4 SEALS

The standard of all sealing of the Works (inclusive of gaskets and membrane seals) shall ensure no reduction in sound insulation performance for its service life.

Gaskets and seals used to achieve the required weather and air flow resistance shall be selected to accommodate fully the range of dimensional tolerances associated with fabrication, installation and movement in situ of the Works sufficient to maintain the acoustic performance required herein. Materials for gaskets and seals shall be capable of maintaining their elastic qualities, dimensions and resistance to physical or chemical attack.

Seals to be used on opening glazing or panels shall be fully continuous. The closure mechanism shall ensure even and adequate compression consistent with maintaining the full acoustic performance.

The Specialist Façade Subcontractor shall provide details and samples of acoustic seals in accordance with the Schedule of Submissions.

#### 4.10 NOISE

The Works shall eliminate creaking, rattling, whistling and any other noises due to the effects of thermal and structural movement and wind and air movement.

The noise output from motors during normal operation shall not exceed 45dB (Laeq max.)

#### 4.11 FIRE PERFORMANCE

##### 4.11.1 GENERAL

The Works, including junctions with other works, and fire breaks that may be incorporated to meet the performance requirements, shall not be composed of materials that readily support combustion and add significantly to the fire load or give off toxic fumes.

The cladding Specialist Façade Subcontractor shall be responsible for ensuring he is aware of, and incorporates, the requirements of the Building Regulations and consulting fire engineer. He shall include firestopping at interfaces with openings, internal partition walls and floor edges. Fire-rated glazing systems including frames and fixing details shall be fully tested to confirm suitability for the proposed installation.

##### 4.11.2 SURFACE SPREAD OF FLAMES

Materials used internally and externally shall have Class O surface spread of flame classification when tested in accordance with BS 476: Parts 6 & 7. All materials shall be non-combustible in accordance with the requirements of the Building Regulations and consulting fire engineer.

#### 4.11.3 FIRE AND SMOKE STOPPING

The Works shall comply with the Fire Certificate Drawings as produced by the Consulting Fire Engineer. They shall comply with the relevant requirements of Technical Guidance / Approved / Approved Document B, the requirements of the consulting fire engineer, BS 9999, and BS 476. The Specialist Façade Subcontractor shall be responsible for ensuring that all and any gaps between the Works and the edges of the structural frame are fire stopped.

The fire rating between compartment floors and walls shall be as identified on the Consulting Fire Engineer's documentation.

The cladding Specialist Façade Subcontractor shall be responsible for obtaining approval for the fire performance of his Works from the consulting fire engineer prior to ordering and manufacture.

All firestopping at slab edges and wall interfaces shall include smoke stopping which shall provide an air seal. These seals shall have IAB or similar EU certification.

#### 4.12 LIGHTNING PROTECTION

The Works shall meet the requirements of EN 62305:2006, parts 1 to 4 inclusive and the requirements of the consulting electrical engineer. The Specialist Façade Subcontractor shall co-ordinate as necessary with contractor responsible for the main lightning protection systems for the building and shall agree appropriate connection points with him for review by the Employer's Representative. No external tapes or visible connections will be accepted.

On-site Equipotential Testing shall be carried out by the Specialist Façade Subcontractor to confirm compliance with the consulting electrical engineer's requirements and integration of the façade into the lightning protection of the building.

The Specialist Façade Subcontractor shall allow for inclusion of fixings and fixing points for electrical connection to the building lightning control system by others.

#### 4.13 BRACKETS AND FIXINGS

The Specialist Façade Subcontractor shall be responsible for the design of all fixings supporting and/or restraining the Works. He shall co-ordinate as necessary all the interfacing elements of work to the satisfaction of the Employer's Representative and consulting structural engineer.

Prior to installation he shall provide details with supporting calculations of his design for every type of fixing together with the loading on those fixings, proving compliance with the requirements of the Building Regulations Technical Guidance / Approved Document A to the Employer's Representative for review.

All anchors and supports shall be designed, fabricated and installed in full compliance with the performance criteria specified without distress to any component or assembly or panel joint integrity. The general requirement for torqueing of bolts shall be highlighted on the Specialist Façade Subcontractor's drawings and tightening torque values to be clearly stated.

All fixings outside or through the vapour barrier shall be stainless steel. All brackets outside the vapour barrier shall be stainless steel or aluminium.

Any devices indicated on the Contract Drawings are schematic only and do not necessarily represent the type shape or profile.

The design of the fixings shall allow for the following:

1. All movements and dimensional changes that may occur in the building due to thermal changes, deflections, settlement and creep.
2. All movements and dimensional changes that may occur to the cladding itself.
3. Constructional inaccuracies of the supporting structure.
4. Adjustments by small increments in and out, up and down and side to side in the position of the cladding supports to accommodate the full variations in the underlying construction.
5. Shimming required accommodating local variations only in construction tolerances. The maximum allowable shim dimension shall be stated in the Specialist Façade Subcontractor's drawings.
6. Any reduction in safe working loads in fixings due to their spacing, location in areas of tension, near edges or proximity to cast in inserts/existing fixings, or thickness of shims.
7. Where post drilled or site fixings are used for connections to the external structural steel frame, the integrity of the steel corrosion protection system shall not be compromised.
8. Where slots are located in line with wind loads or perpendicular to the façade plane to provide tolerance only (not movement), these shall be mechanically locked against movement. Reliance on friction alone shall not be permitted.

Calculations submitted to the Employer's Representative shall show the extent of movements and tolerances, which have been allowed for in the design of fixings.

Bolts, screws and nuts used for fixings the cladding to the structure shall be of adequate strength for their purpose. The Specialist Façade Subcontractor shall state in his calculation the factor

of safety he will achieve. Nuts shall be fully tightened after adjustment to prevent loosening due to movements and/or vibrations.

The design of brackets for site drilled fixings shall allow for the possibility of reinforcement being encountered and the fixing position being moved as a result of this event occurring. No reinforcement shall be cut.

The Specialist Façade Subcontractor shall demonstrate to the Employer's Representative that the use of all proprietary fixings installed have been reviewed and approved by the fixing manufacturer and shall, prior to the installation, submit the Manufacturer's written certification that the details proposed by the Specialist Façade Subcontractor are appropriate for their intended use.

#### 4.14 LOCKED IN STRESSES

The Specialist Façade Subcontractor shall avoid in his design and detailing of fixings, the introduction of locked-in stresses that may be detrimental to the performance or aesthetic of the Works during the service life.

The stresses that are referred to are those that can develop in an individual panel, if the various fixings that secure that panel in position are so rigid that they do not allow for thermal or other movement in that panel.

Such rigidity and resistance shall be avoided by the careful positioning of fixings and preventing slots, which are intended to allow for movements, becoming filled.

#### 4.15 VIBRATION

The primary brackets and all fixings shall be designed so that there will be no risk of loosening due to the effects of vibrations, or to the cyclic effects of load, deflections and thermal movement.

#### 4.16 CORROSION

The Specialist Façade Subcontractor shall select and install each material so that it is, and will remain compatible with the other materials around it within its range of influence for the service life of the Works.

He shall ensure that adequate measures shall be taken to prevent bimetallic corrosion between dissimilar metals. To this end, attention is drawn to publication PD 6484 'Commentary on corrosion at bimetallic contacts and its alleviation'.

Where different metallic materials are used, separators shall be fitted to eliminate the risk of corrosion.

All aluminium or galvanised steel components in direct contact with, but not totally encased in, cementitious surfaces shall be isolated with thin dense PVC or EPDM isolation packs. The use of bituminous paint shall not be accepted.

#### 4.17 INFESTATION

Materials used in the Works shall not be attacked or infested by micro-organisms, fungi, insects or other vermin. The Specialist Façade Subcontractor shall incorporate components to prevent infestation in the Works. All rainscreen cladding shall incorporate stainless steel mesh, max. 6mm grid, 0.6mm wire at base details.

#### 4.18 SECURITY

Ironmongery, where incorporated into the Works shall hold their respective doors in their intended position. They shall withstand the specified design wind load and shall not deflect, drop, or compromise the overall performance of their respective windows or doors for the service life, subject only to routine maintenance and minor repairs.

All ground floor opening windows and doors shall incorporate integrated (hidden) reed switches pre-wired internally ready for connection by others. Wiring shall be brought to floor level with a 5m tail in each location measured from the back of the frame.

#### 4.19 ANTI GRAFFITI

The cladding Specialist Façade Subcontractor is required to recommend suitable graffiti removal materials and procedures for all of his works.

## SECTION 08 44 13

**PART 5 – TESTING**

## 5.1 GENERAL

## 5.1.1 INTRODUCTION

It is intended no project specific off-site structural or weather performance testing should be required for the project. Test reports must be provided by the Specialist Façade Contractor or project specific testing shall be required.

The Specialist Façade Subcontractor shall demonstrate to the Employer's Representative, at times set out in the Schedule of Submissions that the performance requirements of this specification can be met by:

1. Where possible, provide full test reports of:
  - The weathering performance of the proposed systems.
  - The cyclic test results of proposed window and door systems.
  - The structural performance testing of proposed systems.
  - The test result of a completed installation utilising a similar system and of similar size and geometry.
2. Producing structural and calculations for all proposed components and assemblies as set out in the Schedule of Submissions.
3. Submitting detailed design drawings, recognising the requirements of the Contract Documents.
4. Submitting samples for setting of quality control levels.
5. Construction of mock-ups as described in the Contract Documents.
6. Carrying out Weather/structural Performance Testing on Cladding Types where suitable test certificates are not available or acceptable to the Design Team.
7. Carrying out all other performance testing as set out in this document.
8. Construction of on-site quality control samples and independent site hose testing of these samples including completed weathering interfaces with other packages.
9. Testing of materials, finishes, fixings and components as set out in this document.

Should the Employer's Representative deem any of the information unsatisfactory, the Specialist Façade Subcontractor shall be required to weather performance test other areas at his own cost and with no effect on the program.

Representatives from the Design Team shall be given the opportunity to witness all tests. The Specialist Façade Subcontractor shall identify all testing, on his programme for the Works. The Specialist Façade Subcontractor shall give the Employer's Representative fifteen working days' notice of any tests.

## 5.1.2 TESTING AUTHORITY

Testing shall be conducted by an Independent Testing Authority (or authorities) identified by the Specialist Façade Subcontractor and agreed with the Employer's Representative.

Either the testing facilities of the Independent Testing Authority or those of the Specialist Façade Subcontractor may be used, but in either case, the calibration of the equipment, and the witnessing, reporting and certification of the results shall be by the Independent Testing Authority. The Specialist Façade Subcontractor shall submit details of the proposed Independent Testing Authority with his Tender.

The appropriate National Authority shall have accredited the Independent Testing Authority.

All measurement devices used in the tests shall be calibrated to National Standards and shall have current calibration certificates available for inspection by the Employer's Representative.

## 5.2 WEATHER / STRUCTURAL PERFORMANCE TESTING

## 5.2.1 GENERAL

Off-site weather performance testing of all curtain wall and other cladding systems shall be required unless up-to-date weather performance testing results are submitted and accepted by the design team. The tests must be comparable in panel orientation, retention systems, member spans/deflections and loads that would be expected in a job specific test for this project. Weather performance test certificates shall include full details of the tests carried out with associated detail drawings and photographs demonstrating identical construction to the proposed system for the Works.

Weather performance test certificates shall include full details of tests carried out with associated detail drawings and colour photographs, all fully legible.

Photocopied versions shall be rejected. Existing test reports (where proposed) for curtain walling shall not be less than two floors in height and three panels in width. Test certificates must be official copies in English language in accordance with CWCT standard sequence and include hose testing of the specimen within the testing sequence in accordance with CWCT

standard hose test method or similar approved method. If the proposed test certificates are not accepted, project specific off-site tests will be required as noted below. Note: on-site tests are always required.

Where project specific tests are required, full test procedures and detail drawings shall be submitted for approval in good time in order to allow amendment and approval prior to testing as noted below:

## 5.2.2 TEST SPECIMENS

The test specimens shall be designed and constructed using the same methods, materials and sequence as for the Works. The techniques, skills and quality control used for the installation of the test specimen shall be those that are to be used for the installation of the Works.

The test specimens shall be of sufficient size to establish that all elements of the cladding in the specified test area are capable of complying with the specified performance criteria.

The Specialist Façade Subcontractor, in consultation with the Testing Authority, shall provide drawings, showing the size and arrangements of the specimen to be tested including details of the test box. The Specialist Façade Subcontractor shall also provide assembly drawings, details and method statement, and calculations, of the test specimen. These shall be reviewed, revised as necessary, and agreed with the Employer's Representative prior to construction of the test specimen.

The above information shall include details of all jointing, fixing techniques, materials used, type, number and size of drainage/ventilation apertures, and section properties of framing members, strength of concrete, fixings etc.

The Specialist Façade Subcontractor shall co-ordinate all the interfacing elements of work included in the test specimen.

The specimen shall also be used to review proposed assembly and erection methods. If the Employer's Representative requires it, the Specialist Façade Subcontractor shall video record and photograph the test specimen during erection.

Any defects in the test specimen shall be corrected to the satisfaction of the Employer's Representative, Employer's Representative and the modifications shall be incorporated into the remainder of the Works. All defects and modifications shall be recorded by the testing authority and included in the test report.

The test specimens shall be mounted in the test rigs with the conditions of attachment and supports structurally equivalent to those in the Works. The structure supporting the test specimen shall be equivalent in stiffness to that in the building. The Specialist Façade Subcontractor shall detail the interface between the test chamber and the specimen so that the test chamber and its seal to the test specimen does not influence the results of the test.

Should there be a failure during testing this shall be recorded on marked-up testing drawings. Retesting shall only occur when the Design Team and Specialist Façade Subcontractor have agreed the required amendments. Should the test rig fail 3 official tests it shall be dismantled and rebuilt at the cladding contractor's cost, and re-tested until passed. Should the test rig need to be rebuilt, costs associated with attendance of the design team may be off-set against the cladding contractor's contract value.

### 5.2.2.1 STICK SYSTEM CURTAIN WALLING, TOGGLE GLAZED (TO CWCT STANDARD)

1. Air leakage (infiltration, max.) @ 600Pa 0.2 m<sup>3</sup>/hr/m<sup>2</sup>
2. Air leakage (exfiltration, max.) @ 100Pa 0.2 m<sup>3</sup>/hr/m<sup>2</sup>
3. Water penetration – Static @ 600Pa Pass
4. Water penetration – Dynamic (600Pa eq.) Pass
5. Water penetration – hose test Pass
6. Wind resistance – Safety (+ & -3600Pa) Pass

### 5.2.2.2 DOORS (MANUALLY OPERATED, SINGLE LEAF)

1. Cyclic testing (door and ironmongery combined) 500,000 cycles (min)
  2. \*Resistance to repeated opening and closing Class 5
  3. \*Air leakage Class 2
  4. \*Mechanical Strength Class 3
  5. \*Impact resistance Class 1
  6. \*Water penetration – Static Class 4A
- \* Reference EN 14351-1

### 5.2.3 TESTING PROCEDURE AND SEQUENCE, CURTAIN WALLING

The test specimen shall be subjected to tests for air permeability, water leakage, stacking joint movement and resistance to wind loads.

Tests stipulated by this document to which the test specimen shall be subject, shall be undertaken according to The Centre for Window and Cladding Technology, Test Methods for Curtain Walling amended as noted.

The testing sequence shall be:

1. Air permeability/draughts. @ 600Pa
2. Water tightness – static. @ 600Pa
3. Wind resistance – serviceability.
4. Repeat air permeability/draughts.
5. Repeat water tightness – static.
6. Water tightness – dynamic.
7. Hose test (all joints).
8. Wind resistance – safety.
9. Inspect and record.
10. Inspect and record during dismantle (photographic record required)

No tests shall be carried out unless all previous tests in the sequence have been passed to the satisfaction of the Independent Testing Authority. In addition the specimen shall be thoroughly checked from inside the test box prior to each test to ensure that there is no water on the inside face of the specimen. If any modifications are made to the test specimen, including dismantling and reassembly, the Employer's Representative or the Independent Testing Authority, can request that the sequence shall begin again at the first test.

#### 5.2.4 AIR PERMEABILITY TEST

The specimen shall be tested to determine the air infiltration per unit area for fixed panels and per unit joint length for opening lights and junctions between interfacing elements of work.

A check for regions of concentrated air leakage shall be made during the air permeability test. The Testing Authority on a drawing of the specimen shall mark-up regions so identified, with a note of any remedial work that was carried out to eliminate the problem.

Testing shall be carried out in accordance with the requirements of the CWCT Test Methods for Curtain Walling.

#### 5.2.5 WATERTIGHTNESS TESTS

The following test methods shall be employed for assessing the resistance to water penetration:

1. Static test method.
2. Dynamic test method
3. Hose test method

Testing for (a) and (c) shall be carried out in accordance with the requirements of Test Methods for Curtain Walling. The Dynamic Test Method shall be carried out to ENV 13050 with a dynamic pressure of 600 Pa.

#### 5.2.6 WIND RESISTANCE TESTS

The following test shall be employed for assessing wind resistance:

1. Wind resistance - serviceability.
2. Wind resistance - safety.

Testing shall be carried out in accordance with the requirements of the CWCT Test Methods for Curtain Walling.

#### 5.2.7 ERECTION AND DISMANTLING

The Independent Testing Authority shall witness the installation and dismantling of the test specimen. He shall record any variations to the details and method statements on a set of the test specimen assembly drawings prepared beforehand by the Specialist Façade Subcontractor. He shall also record the extent of water penetration into the system together with any other evidence of damage or displacement revealed during the dismantling.

The Specialist Façade Subcontractor shall ensure that any adjustments, additions or changes made to the test specimen to achieve the performance required are included on his drawings prior to any site installation being carried out.

#### 5.2.8 REPORTING

Four copies of the performance test report shall be prepared by the Independent Testing Authority and submitted to the Employer's Representative for review. The report shall contain the information as described in the CWCT Standard for Curtain Walling. It shall include a photographic record of tested areas and recorded leaks. Photographs shall identify precisely the source of leaks and any remedial actions taken.

#### 5.3 DOOR AND WINDOW TESTING

1. REBATED DOORS:

## Cyclical Test:

Repeated Opening &amp; Closing Test Method: EN 1191.

Achieve not less than Class 6 (Frequent) according to EN 12400.

## Mechanical Test:

Test Method: EN 12046-2: Operation Forces.

EN 947: Determination of the resistance to vertical Load.

EN 948: Determination of the resistance to static torsion.

EN 949: Determination of the resistance to soft and heavy body impact.

EN 950: Determination of the resistance to hard body impact.

Classification of Strength: Achieve not less than Class 4 according to EN 1192.

Operating forces: Achieve not less than Class 1 according to EN 12217.

2. DOORS (manually operated, hinged, including APPROVED DOCUMENT Part M compliant threshold):

## Air Infiltration:

Test to 200Pa to EN 12207

Achieve not less than Class 2 (EN 12207 Figure 1)

## Water Penetration:

Test to minimum 150 Pa to EN 12208

Achieve not less than classification 4A of Table 1

Test in accordance with EN 1027 Method 1A

## Wind Load:

Calculate in accordance with EN1991

P1 = calculated wind load

Test in accordance with EN 12211

Classify window in accordance with EN 12210 (Table 1)

Not less than Class C1

3. OPENING WINDOWS (where not project specific tested)

Air Infiltration: Test to 600 Pa to EN 12207.

Achieve not less than Class 4 (EN 12207 Figure 1). Air permeability from average values from positive and negative wind pressures, to be not more than 3.55m<sup>2</sup>/h/m<sup>2</sup> @ 600Pa and 0.62m<sup>2</sup>/h/m<sup>2</sup> @ 200Pa.

Smoke venting openings to be tested to EN 12101-2 for smoke and heat venting.

## Water Penetration:

Test to 1200 Pa to EN 12208.

Test in accordance with EN 1027 Method 1A.

Achieve not less than Class E1200.

## Wind Load:

Calculate in accordance with EN 1991.

P1 = calculated wind load (minimum P1 for acceptance is 2000Pa).

Test in accordance with EN 12211.

Classify window in accordance with EN 12210 (Table 1).

Not less than Class C5/B5.

4. FITTINGS FOR WINDOWS, Testing and Certification:

Test in accordance with the recommendations of EN 13126:

Achieve the following:

Durability, minimum Grade 5 (25,000 cycles).

Mass, tested leaf-mass to be equal or more than the leaf-mass proposed for the Works.

Safety in Use, achieve Grade 1 (safe).

Corrosion Resistance, (EN 1670) achieve Grade 3 (class 3).

Test Sizes, to be in accordance with Table 4 of EN 13126 Part 1, or larger than the proposed windows for the Works.

Mechanical Strength, test in accordance with EN 13126 parts 2 to 17 as applicable (refer to window types shown on the Drawings, Table 4 of EN 13126 Part 1).

## 5.4 MITRE FRAME TESTING

Mitred corners to window insert frames, opening vents, and fixed panels in picture frame (or cassette) systems are to be additionally sealed at these mitred corners with a two part structural adhesive and pumped with compatible sealant, allowed to cure fully prior to transportation. Reliance on small-joint sealant at mitre connections is not accepted. See below for quality control procedures:

1. Provide a photographic method statement indicating the quality control procedures to be undertaken for the cutting, application of structural adhesive, joint sealant application, product tracking material batching, assembly, handling and transportation of the completed insert frame. To be issued for comment and acceptance by the Employer's Representative prior to any structural bonding of glazing for the Works.

2. A fully completed Quality Control sample mitred frame (of the various types and sizes to be used on the project) shall be produced for inspection.
3. The Employer's Representative shall be informed when manufacturing of the mitred frames is started. The Employer's Representative shall be permitted access to the factory at any time during manufacture, without prior arrangement. During that visit the Specialist Façade Subcontractor shall take one of the mitred frames off the production line, cut the frame open into four L shaped pieces. He shall then support the corners in a 'V' position and fill the L shapes with minimum 1lt of water per corner (500ml per leg). The test shall last for 5 minutes per mitre. The mitre fails if any water leaks from the frame. In the event of failure, manufacturing of mitred frames shall be stopped. An additional 5 frames shall be cut and tested as above. If any of these fail, all production shall stop and all mitred frames manufactured prior to the date of the test shall be rejected. The Specialist Façade Subcontractor shall allow for the above inspection/testing to happen a minimum of 3 times during manufacture.
4. Where frames are assembled and sealed without the application of any glazing it is important that they are kept true and square to prevent distortion of same and subsequent damage to the sealed mitre. Jigging of frames shall be carried out where required to prevent distortion during handling and transport.
5. Where mitred frames are to have structural silicone bonded glass, this bonding shall be done in the same factory as the assembly of mitred frames in order to minimise the transport of unsupported frames.

## 5.5 DESIGN DEVELOPMENT MOCK-UPS

### 5.5.1 GENERAL

Design development mock-ups are required to develop the contractor's detailed processes to achieve the required design intent. All sample panels shall be minimum 600mm x 600mm manufactured precisely as proposed for the Works (including all edge finishing etc.):

1. Solar control glass with proposed glass thickness' and composition
2. Spandrel glass including range of colours
3. Curtain walling jointing detail
4. ICM panels with folded joints and support profiles and backing wall
5. Parapet with weathering joint
6. Ironmongery (samples of each proposed component)
7. Hand-samples as required by the Employer's Representative

### 5.5.2 LIST OF OFF-SITE QUALITY CONTROL SAMPLES REQUIRED (MINIMUM)

## 5.6 OFF-SITE QUALITY CONTROL SAMPLES

### 5.6.1 GENERAL

Off-site quality control samples shall be provided in order to ensure the quality of the proposed Works carried out by the Specialist Façade Subcontractor. Failure to provide quality control samples and achieve acceptance from the Contract Administrator may result in rejection of installed Works.

The following items form the minimum quality control samples (including minimum sizes) required to be provided by the Specialist Façade Subcontractor and accepted by the design team as soon as possible during Specialist Façade Subcontractor design development prior to ordering materials for the Works.

Off-site quality control samples shall be provided in an agreed location. They shall be photographed by the Contractor and SFS during assembly, accurately recording all operations for construction as an aid to site installation:

1. Typical curtain wall minimum 1.5 storeys high and 4m wide, with full size insulated glazing panels, intermediate spandrel panel, vision glazing with solar control glazing, perimeter side, bottom corner and soffit perimeter extruded profiles, and ICM rainscreen panel assembly and backing wall. Full backing structure to be included in this mock-up, all provided by the SFS.
2. 1.2m x 1.2m samples of flat insulated glazing units with correct heat treatment perimeter seals, coatings, edge polishing, fritting, lamination, and spacer bars etc. for each type including spandrels. Include samples of any stepped edge fritted glazing units. Each sample to be accompanied by a sample record sheet stating the calculated performance criteria including U value, reflectivity and shading coefficient.
3. Full size sample panel of the largest ICM panel proposed for the Works and associated joint details, horizontal and vertical. This panel shall be measured and confirmed to be within the specified tolerances.

## 5.7 ON-SITE QUALITY CONTROL SAMPLES

### 5.7.1 GENERAL

The Specialist Façade Subcontractor shall erect the first area of each type of the Works not exceeding one structural bay width by one floor height (maximum 20m<sup>2</sup>) and offer these to the Employer's Representative as on-site quality control samples.

He shall present the areas in stages as each layer of material is added.

The standard of workmanship for the Works shall be to an agreed standard established by the construction of the off-site and on-site Quality Control Samples. The Employer's Representative shall review and comment on the On-site Quality Control Samples. Should the Specialist Façade Subcontractor wish to continue with installation of any of the Works before the Employer's Representative has reviewed and commented on the On-site Quality Control Samples, he shall do so at his own risk. The Employer's Representative may require parts of the sample to be dismantled to allow inspection of concealed details. Upon acceptance, the on-site control samples shall remain as part of the installed permanent Works. The Employer's Representative shall reject workmanship that falls below the accepted standard and shall require the Specialist Façade Subcontractor to remove it and re-install it to the acceptable standard.

Prior to construction a programme that details these areas shall be agreed with Employer's Representative. The programme shall identify when they will be inspected and hose tested (see Site Hose Tests below).

The Employer's Representative may wish to inspect items that will be concealed in the final works, prior to covering up, and this programme should identify such intermediate inspections.

### 5.7.2 SITE WEATHER TESTS

ALL HOSE TESTING IS TO BE CARRIED OUT PRIOR TO INSTALLATION OF ADJACENT INTERNAL FINISHES.

As part of the review of each of the On Site Quality Control Samples, site hose tests shall be arranged by the Specialist Façade Subcontractor and shall be carried out by the Independent Testing Authority. They shall be carried out on all On-Site Quality Control Samples on dates to be agreed with the Employer's Representative.

Other areas, randomly selected by the Employer's Representative shall also be hose tested as the Works proceed. The SFS shall allow for testing minimum 10% of all areas by the Independent Testing Authority for randomly selected areas which include interfaces with other works. Should any one test by the Independent Testing Authority fail, an additional 5% of area shall be tested by the Independent Testing Authority, up to 100%. Tests shall be conducted, witnessed and reported in accordance with the requirements contained in this Contract Document by the independent testing authority.

Where the performance criteria specified in this document are not met, the construction shall be opened up, the cause identified, remedial work carried out and accurately recorded, and the area re-tested. Any remedial work shall be agreed with the Employer's Representative before it is carried out. This procedure shall be continued until the Works meet the performance criteria. The Specialist Façade Subcontractor shall then ensure that any modifications are incorporated into all similar areas of the Works.

Prior to hose testing beginning, the Specialist Façade Subcontractor shall submit a hose testing schedule with associated elevations marked up indicating the proposed test areas and associated measured linear meterage of joints in line with the Specification requirements. The Employer's Representative may alter the location of tests.

### 5.7.3 HOSE TESTING

Hose tests shall be carried out in accordance with the specified procedure in Section 9 of CWCT Standard Test Methods for Building Envelopes (December 2005) by the independent testing authority, however, there shall be no taping of joints on opening sections. Hose testing shall include interfaces with rainscreen cladding. Hose testing of roof-lights shall be included.

The order in which the joints in the Works will be tested shall be agreed between the Employer's Representative, the Independent Testing Authority and the Specialist Façade Subcontractor.

The Independent Testing Authority shall check for leaks at the test area and at the floor below the test area inside the building. Internal finishes shall be omitted in the test areas in order to allow clear view of any areas where leakage may occur. Test areas and areas adjacent to the test area shall be continuously monitored for up to 120 minutes after all testing has been completed. If no leak is detected in that time, the area shall be deemed to have passed.

### 5.7.4 COMBINED AIR AND WATER TESTING

During installation, the Specialist Façade Subcontractor shall commission an independent testing authority agreed with the Employer's Representative to carry out not less than 3 site tests of the installed glazed curtain walling and associated interfaces in accordance with the

procedures in AAMA 503-08 'Voluntary Specification for Field Testing of Storefronts, Curtain Walls and Sloped Glazing Systems'.

Each test area is to encompass a minimum of one full storey height x 2 glazed panels' width. At least two of these tests are to include interfaces with rainscreen cladding. Should any test fail, remedial actions shall be proposed for acceptance, remedial works carried out and the area re-tested.

Should any test area fail for a second time the procedure above shall be repeated.

In addition, an additional test area shall be carried out on that elevation to an adjacent bay. If there are any more failures, a further test area shall be identified per test failure up to a maximum of 15 tests.

Testing:

Conduct tests for air infiltration at an air pressure difference of 300Pa.

Maximum allowable rate of air infiltration is not to exceed 1m<sup>3</sup> per hour per m<sup>2</sup> of wall area at this pressure difference.

Conduct tests for water penetration at an air pressure difference equal to 300Pa (negative pressure inside building). There is to be no water leakage at this pressure difference.

#### 5.7.5 REPORTING (ALL TESTING)

4 copies of site hose/air testing reports shall be prepared and submitted to the Employer's Representative for review.

The reports shall contain the information listed under the following headings:

1. Date of test, and of report.
2. Identification of the areas tested on as-built elevation drawings. Plan and vertical section details of the area tested to be provided also. Detailed photographic record of all tested areas and testing apparatus. Detailed photographic record of any leaks identified.
3. A note of the weather conditions particularly wind strength and direction at the time of test.
4. The duration of the test with a statement of how water was applied, where the test started, how it was progressed and where it finished.
5. A statement that the test carried out was in accordance with the standards referred to in this document, or a full description of any deviation from the standards previously agreed by the Employer's Representative.
6. A statement that the test was successful, or alternatively, a note of any leakage through and/or directly below the area being tested, together with an indication of the severity of leakage.
7. Name and author of report.
8. Name and address of Independent Testing Authority that conducted tests, and the requester of the tests.
9. Signature of person responsible for supervision of tests and list of official observers.  
NOTE: the independent testing authority shall be the official observer. Also, the independent testing authority shall carry out the actual hose testing. Operatives of the SFS are not permitted to carry out official testing.
10. Copy of valid calibration certificates for the testing apparatus.

#### 5.8 TESTS TO FIXINGS

##### 5.8.1 GENERAL

In order to demonstrate that his proposed fixings are adequate, the Specialist Façade Subcontractor shall provide all the necessary test data, project specific calculations and technical literature in accordance with the Schedule of Submissions. He shall incorporate an auditable method of recording the quality control testing noted below.

##### 5.8.2 SITE INSPECTIONS OF FIXINGS

As the Works proceed, the Specialist Façade Subcontractor shall carry out inspections to check that:

1. The fixings as detailed on the Specialist Façade Subcontractor's installation drawings have been installed.
2. Every cladding fixing to structure is the right size and is in the right place and has been correctly tightened using a calibrated torque wrench.
3. Fixings do not restrain any intended movement and generate locked-up stresses.

##### 5.8.3 QUALITY CONTROL TESTING OF BOLTS EMBEDDED IN CONCRETE/BLOCKWORK

As the Works are installed, the Specialist Façade Subcontractor shall carry out minimum 10 No. tests on bolts forming part of the Works at each floor level (total number of tested bolts to be minimum 100) to be load tested as follows:

1. The bolts shall be loaded to a minimum load of 1.1 times the design load acting on the bolt. The Independent Testing Authority shall record any horizontal displacement.

2. If any bolts show a displacement of more than 0.1 mm this shall be brought to the attention of the Employer's Representative and project structural engineer. Further testing may be required, or additional fixings may be required at the Specialist Façade Subcontractor's cost.

#### 5.9 MATERIALS TESTING

Materials testing shall be carried out in accordance with the requirements of this Contract Document.

#### 5.10 FINISHES TESTING

Finishes testing shall be carried out in accordance with the requirements of this Contract Document.

#### 5.11 IMPACT, BARRIER AND LOAD TESTING

##### 5.11.1 GENERAL

Impact testing shall be carried out in accordance with this specification to demonstrate compliance with this Contract Document unless valid comparative test certification is provided. The Specialist Façade Subcontractor shall demonstrate that the glazing, aluminium cladding shall satisfy the requirements of CWCT Technical Note No. 52 'Impact performance of cladding'. Impact tests to be carried out on a representative sample of the Contractor's works. The minimum impact values shall be as per table 1 and Appendix B of CWCT TN52 categories B and E in table 2.

#### 5.12 EQUIPOTENTIAL TESTING

Refer to the requirements outlined in Section 8 of the CWCT Standard for systemised building envelopes Part 8. The testing shall be carried out by an independent testing authority agreed with the Employer's Representative. A report shall be provided to the Employer's Representative in accordance with Clause 8.15 of CWCT 'Standard for Systemised Building Envelopes' Part 8. For equipotential testing, the independent authority may be the project electrical contractor responsible for lightning protection of the building.

#### 5.13 AIR TIGHTNESS TEST AND THERMOGRAPHIC INSPECTION

The Specialist Façade Subcontractor shall assist the Contractor in demonstrating the air leakage characteristics of the building. The test shall be undertaken by an accredited specialist agreed with the Employer's Representative, in accordance with the procedure set out by the ATTMA arranged by the Contractor.

A further air tightness test may be independently commissioned by the Employer's Representative near completion of the project. The Specialist Façade Subcontractor shall allow for attendances at both and performance as set out below.

The air leakage rate through the envelope enclosing the building volume being tested shall be targeted to achieve not more than  $X$  cu.m/hr/sq.m at a pressure difference of +50 Pascals between the inside of the building envelope and the outside of the building envelope, as specified by the Employer's Representative's Consulting Mechanical Engineer.

In the event of the test demonstrating an air leakage in excess of the specified rate, the testing authority shall investigate possible sources of excessive air leakage. The Specialist Façade Subcontractor shall allow for opening up locally to assist in this investigation. If it is found that the Specialist Façade Subcontractor's works is deemed to be the source of the excessive air leakage the Specialist Façade Subcontractor shall locate and identify all unplanned leakage paths and submit to the Employer's Representative for review, his proposals for remedial works. This shall include all necessary uncovering and making good of concealed elements of the fabric. The Specialist Façade Subcontractor shall assist the Contractor in re-testing the building to demonstrate that the air leakage rate is within the limits specified above, after these measures have been undertaken.

Air leakage will be deemed to be satisfactory when total leakage for the building volume being tested is within the value specified above and that such leakage paths that remain are evenly distributed around the enclosing envelope.

Concentrations of air leakage, which may have an adverse effect upon local environmental conditions within the zone of the building in which they occur as judged by the Employer's Representative, will not be acceptable.

It is envisaged that Thermographic inspection of the façade will be carried out.

Should this demonstrate any defects in the performance of the façade the Specialist Façade Subcontractor shall be required to rectify these defects at his own cost with no provision for additional time.

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**PART 6 – MATERIALS**

## 6.1 GENERAL

## 6.1.1 COMPLIANCE WITH STANDARDS

Unless otherwise described, all materials shall conform to the appropriate current European or British Standard Specifications. The Specialist Façade Subcontractor shall provide the Employer's Representative, on request, with guarantees, or certificates of conformity, from the prime material manufacturers and suppliers proving that the materials to be used do in fact conform to such specifications. These guarantees or certificates shall also confirm that the materials are suitable and appropriate for their intended use within the Works and will satisfy this Contract Document.

## 6.1.2 SOURCES OF MATERIALS

In accordance with the schedule of submissions, immediately after contract award (within two weeks) the Specialist Façade Subcontractor shall provide for the Employer's Representative's review a complete list of the proposed materials and their sources. He shall also provide documents from the sources as evidence of their ability to carry out the tasks expected of them, and written confirmation that the materials they are supplying are suitable and appropriate for their intended use and will satisfy this Contract Document.

The Specialist Façade Subcontractor shall obtain the total quantity of each material from the same manufacturer produced in one batch.

The Specialist Façade Subcontractor shall obtain materials from established and reputable manufacturers, particularly those who are prepared to assist him with the design process, through to the fabrication and final installation on site.

## 6.1.3 IDENTIFICATION OF MATERIALS

All principal materials delivered to the factory or site shall bear the manufacturer's name, brand name or any other data that may be required to verify the exact nature of the material and relate it to the requirements of this Contract Document. Where applicable, the material shall bear the Works test certificates, British Standards Certification, Trade Mark, CE Mark and/or British Board of Agrément Certificate mark. Test certificates shall include, whenever applicable, the location in the Works or the delivery or batch which the sample represents.

## 6.1.4 COMPATIBILITY OF MATERIALS

The Specialist Façade Subcontractor shall select and install each material so that it is, and will remain, compatible with the other materials around it and within its range of influence for the service life of the Works.

## 6.1.5 UNSPECIFIED MATERIALS

As part of his submissions after appointment, the Specialist Façade Subcontractor shall submit a list of all materials he proposes to use that are not specifically described in this Contract Document. These materials shall conform to the general requirements specified herein. Unspecified materials shall be subject to review by the Employer's Representative.

## 6.1.6 DELETERIOUS MATERIALS

Materials shall be selected by reference to the good practice guide 'Good Practice in the Selection of Materials' available from the British Council of Offices (BCO) and the British Property Federation (BFP).

## 6.2 ALUMINIUM COMPONENTS

## 6.2.1 EXTRUSIONS

All extrusions to be polished to avoid visible draw-lines and differential surface roughness surfaces. All extruded aluminium for framing members shall have the chemical composition and temper appropriate for its function, exposure and applied finish. They shall comply with EN 755, BS 1161, BS1474 and EN 515.

Design shall comply with BS 8118. The extrusions shall have the webs, walls, and flanges of sufficient thickness to satisfy all structural requirements and eliminate permanent distortion of elements in the finished Works.

## 6.2.2 SHEET, STRIP AND PLATE

Sheets for hidden flashings shall not be less than 2mm thick. Sheets for all components exposed to view or to impact including copings, panels and visible closures shall not be less than 3mm,

and shall have the chemical composition and temper appropriate for its function. They shall comply with EN 485 and EN 573.

Sheets for anodising shall be Novelis J57S alloy or equivalent to achieve uniformity of appearance.

#### 6.2.3 ALUMINIUM WELDING AND CONSUMABLES

Consumables shall be stored, handled and used in accordance with manufacturers' recommendations. They shall comply with BS 2901- 4, and BS 8118.

### 6.3 ICM PANELS

ICM panels shall incorporate non-combustible core material. Reference material aesthetic is Kingspan KS 1000 RW. Panel manufacturer must be in business for not less than 10 years manufacturing and developing the proposed material.

Bond Integrity:

When tested for bond integrity, in accordance with ASTM D 1781 (simulating resistance to panel delamination), there shall be no adhesive failure of the bond a) between the core and the skin nor b) cohesive failure of the core itself below the following values:

Peel Strength:

100 N•mm/mm as manufactured.

100 N•mm/mm after 21 days soaking in water at 70°F (21°C).

Fire Performance:

ASTM E 84 Max. Flame Spread 25, Max. Smoke Developed 450.

NFPA 285 Panels shall meet requirements of the Intermediate Scale Multi Story Test.

### 6.4 STEEL COMPONENTS

#### 6.4.1 STAINLESS STEEL

##### 6.4.1.1 PLATE, SHEET AND STRIP

Sheet material is proposed as minimum 2mm thick with surface roughness not exceeding 0.4 microns.

Stainless steel in profile, plate, sheet and strip shall comply with EN 10029, BS 10048, EN 10258, EN 10259 and EN 10088 as appropriate.

Unless noted otherwise, grade 1.4435 (formerly 316L) shall be used for visible components, in all other circumstances grade 1.34xx (formerly 304) may be used.

##### 6.4.1.2 FIXINGS AND FASTENERS

Fixings and fasteners shall comply with EN ISO 3506-1 and EN ISO 3506-2.

Unless noted otherwise, grade A4 shall be used for visible fasteners, in all other circumstances grade A2 shall be used.

The fastener property class shall be selected by the Specialist Façade Subcontractor so as to meet the performance criteria specified herein.

##### 6.4.1.3 SECTIONS

Stainless steel sections shall comply with EN 10088-3.

##### 6.4.1.4 WELDING CONSUMABLES

Welding consumables shall comply with EN 12072 and/or EN 1600 as appropriate.

#### 6.4.2 MILD STEEL

##### 6.4.2.1 GENERALLY

The use of mild steel shall only be permitted where the component is readily accessible for regular inspection and maintenance.

Where used, it shall be one of the following:

1. Hot rolled steel complying with the requirements of EN 10025.
2. Hot rolled sections to BS 4: Part 1, EN 10210-2 and EN 10021-1, tubes to BS 6323: Parts 1, 2 & 3 and angles to BS 4848: Part 4.
3. Cold formed pre-galvanised steel sections to EN 10142, EN 10143, EN 10147
4. Steel sheet to BS 1449: Part 1.
5. Ordinary bolts and nuts to EN 24032, EN 24033, EN 24034.
6. All plain and tapered washers to BS 4320, Form E.

#### 6.4.2.2 HOT DIP GALVANISING

Where mild steel sections or fabrications are hot dip galvanised the following additional specification shall apply. The use of coil coated galvanised sheet shall not be permitted where condensation or water may be present.

1. Mild steel shall have a carbon equivalent (calculated by the IIW formula) equal to or less than 0.43%
2. All welding procedures and welding procedure specifications shall be limited to a maximum carbon equivalent of 0.43%.

#### 6.4.3 WELDING PROCEDURES AND CONSUMABLES

Consumables shall be stored, handled and used in accordance with the manufacturers' recommendations.

Consumables for use in metal arc welding shall comply with EN 499, EN 440, EN 756 or EN 758 as appropriate.

#### 6.5 GLASS

##### 6.5.1 GENERAL

Glass shall comply with the provisions of EN 572 and BS 952.

All glass shall be manufactured on a float-line. All glass shall be analysed at the float plant for inclusions greater than 70 µm. Any glass with inclusions in excess of 70 µm shall be rejected. Certification to be provided by the float glass manufacturer confirming the glass provided for the Works has been checked and meets this requirement.

The thickness and dimensions of glass shown on the Design Intent Drawings are not prescribed thickness or dimensions. The Specialist Façade Subcontractor shall calculate the glass thickness, using the recommendations in BS 6262 and BS6399 and validated proprietary design methods to meet the structural, environmental, acoustic and safety requirements.

All visible edges of glass shall be fully polished with dubbed corners. Samples of proposed edge finishing shall be provided prior to manufacturing of the works.

##### 6.5.2 VISUAL ACCEPTANCE CRITERIA

All glass shall be clear float glass. The glass shall be clean cut, polished, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks ripping dimples or other defects.

Distortion shall be kept to an absolute minimum and no local defects producing irregular reflections shall be allowed.

The quality of all glass off the float line shall be assessed for optical and visual faults as described in EN 572-2. Spot faults shall not be worse than category C. There shall be no linear/extended faults. For optical faults, acceptance levels shall be as described.

Visual acceptance criteria for as-installed insulated-glazing shall be gauged against the guideline prepared by the Technical Advisory Board of the Institute of Glazing Trade for Glazing Technology and Window Manufacture, Hadamar (IGH, Hadamar) and the Federal Association for Wholesale Architectural Glazing, Insulating Glass Manufacture, High Performance Glazing, Troisdorf dated October 1996 shall be used to assess the visual quality of insulating glass units except that this specification shall be used to assess roller wave and bow for toughened glass and this specification shall be used to assess anisotropy in heat strengthened and toughened glass, not the criteria found in the guideline.

The glass shall be assessed in both transmission and reflection with a maximum viewing angle of 30° between the normal to the surface of the laminated glass and the position of the observer. A full size sample shall be provided, prior to start on site, of the final quality of the finished glass. This is to demonstrate the quality of glass, spacer bar, carrier frame and insulated glazed unit edge seals. The samples shall be to a standard agreed by the Employer's Representative.

The accepted samples shall be kept protected by the Specialist Façade Subcontractor as a control sample on site for review against installed glass if the quality of the installed glass is in question. Repair of damaged glass shall not be permitted. It shall be replaced with new.

##### 6.5.3 SAFETY AND THERMAL STRESSES

The Specialist Façade Subcontractor shall ensure that no glass or glazing combination develops stresses that may lead to damage of glass, glazing materials, components and/or framing systems.

The Specialist Façade Subcontractor shall conduct a thermal stress analysis, undertake thermal calculations and make due allowance for any toughened glass which may be required.

He shall take into account shading stresses that might occur from shading devices. The Specialist Façade Subcontractor shall agree with the Employer's Representative the allowable specification of mechanical properties for internal blinds to all elevations where appropriate

which do not form part of this package. This is in order that the warranty provided by the glass manufacturer takes into account the likely stress from these blinds.

#### 6.5.4 SIZES

All glass shall be cut to accurate sizes and delivered to site in the required sizes.

No on-site cutting or nipping shall be allowed. The glass shall be clearly marked to show its intended final position and orientation.

#### 6.5.5 TOUGHENED GLASS

THE USE OF FULLY TOUGHENED GLASS IS TO BE AVOIDED WHEREVER POSSIBLE TO MITIGATE THE RISK OF SPONTANEOUS BREAKAGE. FULLY TOUGHENED GLASS SHALL NOT BE USED IN ANY LOCATION WHERE THICKER HEAT STRENGTHENED GLASS COULD BE A SUBSTITUTE.

The Specialist Façade Subcontractor must satisfy himself that glass toughening requirements are satisfactory to meet wind or other loads anticipated in the Works. The prime manufacturer of the toughened glass shall be made aware of its intended use in the construction. Any drilling and notching is to be done with the agreement of the prime manufacturer of toughened glass and prior to the toughening being carried out. All toughened glass shall be tempered on a roller hearth furnace eliminating tong marks and shall conform to BS 6206 Class A.

All toughened glass shall be manufactured in accordance with EN 12150. ALL fully toughened glass shall be heat soak tested for a minimum of 2 hours at 290 degrees C, in accordance with EN14179 and should also achieve equivalent to ESG-H 'geregeltes Bauprodukt' (external supervised product) classification, to convert all Nickel Sulphide inclusions greater than 40 µm in diameter from the alpha to the beta phase so that the glass will fracture in the test. After the test the probability of failure in service should be less than 1 in 400 tonnes.

The manufacturer shall, at the request of the Employer's Representative, show by statistical analysis of test data that the probability of failure is not greater than the value quoted above.

Edge dip is taken as the measurement taken within 200mm of the edge of the glass.

The glass shall conform to the following requirements in the horizontal toughening process when measured with a Strainoptics digital micrometer:

Flat glass, vision and spandrel units:

1. Maximum Bow (deviation from intended line) - 0.15%
2. Roller Wave - 0.15 mm max depth (over 300mm)
3. Edge dip - 0.25 mm maximum

Flat glass where used to construct laminated glazing (pieces to be roller-matched to prevent optical distortion when laminated. Optical distortion will be rejected):

1. Maximum Bow - 0.15%
2. Roller Wave - 0.15 mm max depth
3. Edge dip - 0.20 mm maximum

All glass edge working shall be fully polished where visible, and flat ground with no bright spots for all other areas, with a small arris. Corners shall be dubbed.

Small shells and/or chips shall be ground out prior to toughening. Maximum chip/shell diameter shall not exceed 2 mm, and there shall not be more than four randomly placed chip/shells in any single pane of glass.

The surface compressive stress shall be demonstrated by non-destructive testing to be controlled at the factory to be greater than or equal to 100 N/mm<sup>2</sup>.

Samples of at least 900 x 900mm shall be provided for each thickness of glass to demonstrate the roller wave that will be obtained.

The appearance of anisotropy or 'Leopard Spots', a multi-coloured pattern, is known to be associated with toughened glass under certain polarised lighting conditions. This will not be considered a fault unless it is visible in a range of reasonably typical naturally occurring conditions. Any coatings applied to the glass must not increase the tendency to show these effects and samples must be submitted for assessment.

##### 6.5.5.1 HEAT SOAK TESTING

The manufacturer shall, provide the following during the Works:

1. Each individual glass pane to be marked with UV ink prior to heat-soak testing, with the date of heat soak testing directly adjacent to the glass stamp. A HST Checkmarker or similar shall be used to ensure all glass is processed as specified:  
(<http://www.boraident.de/index.php?pid=41&state=page&action=default>)  
The marking shall be positioned to allow inspection with UV light after installation. Any fully toughened glass found without this marking shall be rejected.
2. Record of heat soak testing of each batch.
3. Record to provide time versus temperature record for each batch.
4. Calibration certificates for thermocouples and oven relevant to each batch.

Calibration to be not more than 12 months old.

5. Record of any breakages that occur during heat soak testing.

#### 6.5.6 HEAT STRENGTHENED GLASS

All heat strengthened glass shall be tempered on a roller hearth furnace eliminating tong marks. The glass shall conform to the following requirements in the horizontal toughening process when measured with a Strainoptics digital micrometer:

Flat glass:

1. Maximum Bow - 0.1%
2. Roller Wave - 0.15 mm max depth
3. Edge dip - 0.25 mm maximum

Flat glass where used to construct laminated glazing (pieces to be roller-matched to prevent optical distortion when laminated):

1. Maximum Bow - 0.1%
2. Roller Wave - 0.15 mm max depth
3. Edge dip - 0.20 mm maximum

Edge working shall be as per fully toughened glass above. Raw cut edges that are only dressed will not be accepted. Corners shall be dubbed.

Small shells and/or chips shall be ground out prior to toughening. Maximum chip/shell diameter shall not exceed 2 mm, and there shall not be more than four randomly placed chip/shells in any single pane of glass.

The surface compressive stress shall be demonstrated by non-destructive testing to be between 35 N/mm<sup>2</sup> and 55 N/mm<sup>2</sup>. Records of non-destructive testing to be provided during the Works.

#### 6.5.7 LAMINATED GLASS

Laminated glass shall comply with EN ISO 12543. Where the edge of laminate glass is to be exposed, the interlayer material must be shown to be resistant to the effects of moisture absorption, including clouding and delamination. Any delamination that exceeds 8mm from the edge of the glass shall be deemed failed and shall be replaced under warranty by the SFS. All laminated glass shall conform with BS 6206 Class A or equivalent to EN12600 (1B1).

All annealed laminated glass shall be edge worked post-lamination (flat ground with no bright spots, ground arris and corners dubbed) to ensure even dispersion of self-weight when glass is installed in vertical position. Edge finishing shall be to a quality suitable to prevent thermal stress cracking and not less than Specified.

All laminated glass panels shall have a single 'control' edge. This shall be indicated by a removable sticker on the glass during transport and installation.

The control edge shall be flush with no step in glass lights to ensure even spread of load.

Laminated glass shall be manufactured using vacuum bagging and autoclave to achieve a durable product with minimal risk of de-lamination.

The guideline prepared by the Technical Advisory Board of the Institute of Glazing.

Trade for Glazing Technology and Window Manufacture, Hadamar (IGH, Hadamar), and the Federal Association for Wholesale Architectural Glazing, Insulating Glass Manufacture, High Performance Glazing, Troisdorf shall be used to assess the visual quality of laminated safety glass.

The glass shall be assessed in both transmission and reflection with a maximum viewing angle of 30° between the normal to the surface of the laminated glass and the position of the observer.

#### 6.5.8 LOW EMISSIVITY COATING

Low emissivity coating, if required to achieve the performance criteria specified, shall be positioned on surfaces 2 or 3. It shall be nominally neutral in colour and uniform in tone, hue, colour, texture, pattern and opacity and shall provide a consistent appearance to the glazed units. The emissivity shall be less than 0.2.

Coatings shall be edge deleted in accordance with the coating manufacturer's instructions and this Specification.

##### 6.5.8.1 COLOUR CONTROL

Coatings, in combination with the glass to which they are adhered, shall be uniform in appearance. Where there is a dispute, measurements shall be carried out at the SFS cost using a portable sphere spectrophotometer (X-Rite SP62 or similar). The Employer's Representative shall select the areas for measurement.

Measurements shall be captured in L\*a\*b\* colour values. Delta values shall be ascertained measuring between the 'reference' panel location and the target location. The difference between adjacent panels shall be represented as a Delta value for each of the L\*a\*b\* colour values and shall be maximum 1.5 for each.

Measurement procedures shall be carried out in accordance with the European Association of Flat Glass Manufacturers 'Code of practice for in-situ measurement and evaluation of the colour of coated glass used in façade' and EN 1096-1.

#### 6.5.9 CERAMIC INK APPLICATION

Ceramic ink shall be applied to areas of heat treated glass as indicated on the Contract Documents using the silk screen or digital print process (for patterns) or roll-on (for 100% coverage, spandrel panels). All pigment for one job shall be from one source in one or consecutive batches.

Samples shall be submitted prior to mass-manufacture for review by the Employer's Representative. Colour variation shall be as per 6.5.9.1 above. All ink application and toughening/heat-strengthening of glass shall be carried out in one location (flat and curved).

The ceramic ink shall be fused to the surface of the glass during the heat treatment process and be permanent and durable and shall be resistant during the design life of the Works to:

1. Attack from mechanical damage or abrasion, during normal use and maintenance as specified by this Contract Document.
2. Weathering, fading, or discolouration due to attack from climatic conditions, UV or atmospheric pollutants.

#### 6.6 GASKETS

Gaskets and seals used to achieve the required weather and airtightness shall be selected to fully accommodate the range of dimensional tolerances associated with fabrication and installation of the Works. They shall be formed with materials capable of maintaining their elastic qualities, dimensions and resistance to physical and chemical attack sufficient to maintain the full performance during the design life. Gaskets providing the water and air seals shall be formed into complete frames with factory formed injection moulded vulcanised corner joints.

Gaskets shall be free from contact and migration stain and shall be compatible with all substrate, sealant and finishes with which they are likely to come into contact. The gaskets shall be free of mould flash.

Extruded rubber gaskets shall comply with BS 4255. Cellular profiled gaskets shall comply with ASTM C509. The Specialist Façade Subcontractor shall comply with the manufacturer's recommendations for specific conditions of use wherever a range of hardness or compressibility is available for a product. All materials must be compatible with substrate, sealants, finishes and other materials in joint systems.

#### 6.7 INSULATION

Thermal insulation shall be inert, durable, rot and vermin proof, CFC and HCFC free, shall not support mould fungal or bacteria growth and shall provide the specified made for the reduced performance of insulation due to the effects of moisture and ageing.

Thermal insulation shall be sufficiently robust and cohesive to allow it to be removed and replaced in service without loss of material or performance. It shall not be injurious to human health when being properly installed, when in service and when being removed or replaced.

Insulation materials and any associated adhesives shall be non-combustible.

Insulation shall be manufactured from external grade non-combustible mineral wool fibre or similar approved by the Design Team. Where used in a rainscreen, it shall be rigid, and shall not be degraded by the presence of water on its surface.

#### 6.8 SETTING BLOCKS

Setting blocks shall be polychloroprene (Neoprene), polypropylene or EPDM of an appropriate Shore A hardness. Carbon compounds for fillers and durability agents shall not leach out over time and cause staining.

#### 6.9 SEALANT (NON-STRUCTURAL)

In general, sealant shall be selected and applied in accordance with the guidelines contained in BS 6213 and EN ISO 11600. Sealant shall be:

1. Silicone sealant.
2. One or two part polysulphide sealant.
3. As proposed by the Specialist Façade Subcontractor to the appropriate British or European Standard, subject to written confirmation being provided by the manufacturer that his product is being used in appropriate manner in an appropriate situation.

Backing rods shall be closed cell polyethylene foam. When closed cell sections are used non-gassed produced shall be selected.

The colour of visible sealant used shall be as specified on the Design Intent Drawings.

#### 6.10 MATERIALS USED FOR FLASHINGS

Flashings shall maintain their performance and properties for the expected service life of the product.

They shall resist the deleterious effects of water, cleaning agents, temperature variations expected from the specified temperature ranges, gaseous pollutants (including ozone), weak acids deriving from gaseous pollutants dissolved in water and UV radiation to which they may be exposed during installation and in service.

Flashings shall have appropriate water vapour permeability. The water transmission properties of the material and the complete construction shall preclude the inward passage of liquid water, but permit the release to outside over time of harmful condensation and other trapped water.

Flashings shall have the necessary mechanical properties to withstand installation and specified design loads.

The material used shall be, stainless steel, coated aluminium or one of the following membranes continuously supported by aluminium or stainless steel:

Flexible ethylene-propylene diene monomer (EPDM) min. 0.7mm thick.

Flexible aluminium foil backed butyl rubber.

Proprietary membrane waterproofing systems shall have independent certification of design and performance prepared by the Irish or British Board of Agrément.

The Specialist Façade Subcontractor shall also provide written confirmation from the manufacturer that the manufacturer has seen the details and stating that his material is suitable and appropriate for its intended use. The flashing material shall be non-combustible and be certified with a class O spread of flame.

Visible flashings shall be polyester powder coated aluminium minimum 3mm thick with welded corners and folds.

#### 6.11 TIMBER

NOTE: No timber shall be permitted as any part of any façade. This includes grounds for fixings and backing structures

#### 6.12 VAPOUR CONTROL LAYERS

Vapour control layers shall maintain their performance and properties for the expected service life of the product. They shall resist the deleterious effects of water vapour, temperature variations expected from the specified temperature ranges, gaseous pollutants (including ozone), weak acids deriving from gaseous pollutants dissolved.

The vapour control layer shall have a vapour resistance greater than the sum of the vapour resistances of the materials used on the cold side of the insulation.

The vapour transmission properties of the material and the complete construction shall preclude the inward passage of liquid water, but permit the release to the outside in the form of water vapour over time, of harmful condensation and other trapped water.

The material used shall be, stainless steel, coated aluminium or one of the following membranes continuously supported by aluminium or stainless steel:

Flexible ethylene-propylene diene monomer (EPDM) min. 0.7mm thick

Flexible aluminium foil backed butyl rubber min. 1mm thick.

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**PART 7 – FINISHES**

The SFS shall employ the services of an independent finishes specialist to ensure compatibility of finishes and to agree all quality control procedures prior to application of finishes for the Works. The independent specialist shall visit each finishing facility (including galvanising) to review quality control procedures and confirm compatibility of proposed processes and finishes to meet the requirements of this Specification. Prior to application of ANY finishes, the independent specialist shall provide a report on the proposed applicators confirming compliance with the specification and expert opinion on their suitability for providing the required finishes. All finishes applicators (including galvanising) shall be ISO 9001 certified and independently audited. Latest audit report shall be provided to the Employer's Representative for each (not more than 6 months old).

**7.1 STAINLESS STEEL FINISHES**

Stainless steel shall be supplied with finishes to both sheet, cast and rolled components, all grade 1.4435 (316L) as minimum.

Generally all visible surfaces in stainless steel materials shall be as defined by samples provided by the Specialist Façade Subcontractor. Finish as specified with maximum surface roughness of 0.4 microns (aesthetic reference equivalent to 4N by Outokumpu). The direction of the texturing shall be the same in any continuous run of panels and shall be vertical when installed. The stainless steel finish selected shall not discolour during its design life when subjected to normal atmospheric conditions.

Samples are to be submitted for approval by the Employer's Representative prior to manufacture.

Surface roughness (measured transversely across the grain) shall not exceed 0.4 microns in any areas exposed to external air where stainless steel components are visible.

With the exception of hidden welds, welds shall be fully finished, butt welds shall be finished to a maximum 4mm arris unless otherwise advised, to the above finishes standard.

All stainless steel shall be passivated and chemical cleaned by a specialist stainless steel cleaning contractor appointed by the Specialist Façade Subcontractor upon installation prior to hand-over.

**7.2 POLYESTER POWDER COATING****7.2.1 GENERAL**

Polyester powder coating on aluminium shall comply with the minimum requirements of BS6496 where applied to aluminium. They shall comply with the requirements of EN13438 where applied to galvanised steel. The external PPC system and applicator shall be certified 'Super-Durable' Class 3 in accordance with Qualicoat requirements. The internal PPC system and applicator shall be certified Class 2 in accordance with Qualicoat requirements. The Specialist Façade Subcontractor shall inform the coating applicator where the profiles are intended to be exposed to a corrosive environment. The Applicator shall adjust coating parameters beyond the requirements of the above standards where, in his expert opinion, he feels it is required to deal with the environment and achieve the required life-cycle durability and warranty.

The coating shall be carried out by an applicator nominated by the Specialist Façade Subcontractor, approved by the polyester powder manufacturer and agreed by the Employer's Representative. The same, single powder coating applicator shall be used for the duration of the Works. If the Specialist Façade Subcontractor elects to use more than one PPC applicator, all requirements noted below are to be duplicated.

**7.2.2 COLOUR**

The coating finish colour and gloss levels shall be as per the Employer's Representative's requirements. Allow for metallic finishes.

A colour match is defined within BS 2015 as 'paints are said to match if under certain conditions of illumination and viewing, no significant differences in their colour, can be detected'. The Employer's Representative shall be the sole arbiter regarding what is understood by 'significant' and what can be 'detected'. He shall be the sole arbiter regarding acceptance of colour, gloss and hue.

**7.2.2.1 COLOUR MEASUREMENT**

When compared under natural diffuse daylight as described in ISO 3668: 2001, the finish on all visible surfaces shall match the accepted reference samples.

Quality control samples shall be measured prior to going into mass manufacture, by the Specialist Façade Subcontractor's independent paint inspector. Periodic measuring by the coating applicator shall also be carried out to the same standards.

#### 7.2.3 SERVICE LIFE

The minimum service life as defined in BS7543 shall not be less than 25 years.

#### 7.2.4 AGRÉMENT CERTIFICATES

Powder coating shall be carried out in full compliance with the appropriate Agrément Certificate. A copy, headed with the name of the project and countersigned by a director of the coating company shall be submitted to the Employer's Representative before any production commences.

#### 7.2.5 SIGNIFICANT SURFACES

All visible surfaces and other surfaces exposed to the external environmental conditions shall be deemed to be significant surfaces. These shall include any drained and ventilated cavities and pressure equalisation chambers.

The Specialist Façade Subcontractor shall note all significant surfaces on his drawing and provide the Employer's Representative with written confirmation from the powder coating applicator that full coverage in accordance with this specification is achieved.

#### 7.2.6 FABRICATION REQUIREMENTS

Fabrications shall be from pre-finished or finished machine lengths at the recommendation of the powder coating applicator. The Specialist Façade Subcontractor shall state in his Tender, which he has used. No visible or exposed areas of un-coated metal or unsealed crevices open to the exterior shall be accepted.

Any area where coating is carried out after machining, satisfactory jiggling points shall be arranged between the Specialist Façade Subcontractor and the powder coating applicator. Where necessary, drain holes shall be provided.

Two sample joints shall be submitted to the Employer's Representative for approval, prior to fabrication.

All welds, burrs and other edge machining shall be ground smooth to the requirements of the powder coating applicator prior to coating.

The Specialist Façade Subcontractor shall ensure uniformity of colour, texture and gloss, on the completed elevations, between adjacent panels and/or components within the approved control samples. He shall agree with the powder coating applicator, a sequence for coating the various elements in consistent batches. Particular attention shall be paid to small components such as any exposed fixings, plates, snap on cover plates and the like.

#### 7.2.7 CONTROL SAMPLES

Colour control limits shall be submitted with the Tender. Prior to the commencement of the powder coating, the Specialist Façade Subcontractor shall, in conjunction with the Applicator, submit to the Employer's Representative for approval, the following samples showing the variations in colour and texture:

1. 2 No. extrusions, typical for the works, each 1200mm long showing the lower and upper range limits.
2. 2 No. sheets, typical for the works, but each not less than 1200mm x 1200mm showing the lower and upper range limits.

Once approved and signed off, the Specialist Façade Subcontractor shall label and sign each sample in five separate locations and arrange for the samples to cut into five equal sizes. The samples shall then be distributed as follows:

1. The Contractor.
2. The Employer's Representative (2 No. samples).
3. The powder coating applicator.
4. The Independent Inspector.

The respective parties shall keep these for the duration of the Works. The Employer's Representative shall use these samples to agree or otherwise any disputed finishes.

#### 7.2.8 PERFORMANCE CRITERIA FOR THE POWDER COATING

Prior to the commencement of production, the powder applicator shall provide a copy of the powder manufacturers certificate confirming that the powder coating complies with the minimum performance requirements stipulated in Section two of BS6496. In the case of weathering tests, unless otherwise agreed with the Employer's Representative; the powder coating shall meet the requirements of both the artificial and natural weathering tests.

## 7.2.9 ACCEPTANCE TESTING

### 7.2.9.1 THIRD-PARTY INSPECTION

The Specialist Façade Subcontractor shall make provision for the independent inspector to attend site to measure colours, and to attend the PPC facility to carry out an initial review of quality control procedures of the PPC coating facility and their ability to match the required colours.

In addition to this, allow for a minimum of three acceptance inspections to be conducted by the independent inspection authority per PPC processing facility. The independent inspection authority shall be experienced in the assessment of powder coated aluminium finishes. The Specialist Façade Subcontractor shall provide details of the proposed independent inspection authority at the time of tender to the Employer's Representative for review. If, for whatever reason, third-party inspection is not implemented as specified, the Employer's Representative shall instruct an independent inspection authority to carry out the specified inspections and shall make a financial adjustment to the Sub-contract sum to cover the costs involved.

In the case of dispute between the powder coating applicator's test results and those of the independent inspection authority, the results of the independent inspection authority shall take precedence. In the event of dispute regarding the acceptability of the colour match, the Employer's Representative shall be the sole arbiter.

### 7.2.9.2 SAMPLING PROCEDURES

Sampling procedures and plans shall comply with BS6001: Part 1 (ISO2859/2) for general inspection Level 2, AGL = 1% on each colour and finish used in the Works.

These inspections must be carried out in the powder coating plant prior to fabrication.

### 7.2.9.3 TESTING REQUIREMENTS

Unless specified otherwise, all inspections and tests on the finished coating shall comply with the minimum requirements of BS6496 Section 10.

### 7.2.9.4 APPLICATORS CERTIFICATE

The Specialist Façade Subcontractor shall provide the Employer's Representative with certificates which state that the finish complies with the requirements of this specification.

The Employer's Representative prior to the receipt of the Applicator's Certification cannot sign certificates of practical completion, or any other documentation accepting responsibility.

### 7.2.10 TEMPORARY PROTECTION

All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations shall be fully protected for the duration of the works.

Protective coverings shall be resistant to all weathers and be removed from areas inaccessible after installation. They shall be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations.

Any protective tapes used in direct contact with the coating shall be a low tack, self-adhesive type in white or any colour lighter than the coating to be covered.

It shall be applied and removed in accordance with the recommendations of the powder manufacturer guidelines.

Protective tapes shall not be kept in contact with coated surfaces for longer than months.

Particular attention shall be paid to any wet applied weathering sealant. The covering shall allow for protection to the sealant during curing and shall not compromise the sealant's long term performance in any way.

Should the protective covering need to remain in place following installation, the Specialist Façade Subcontractor shall, in conjunction with the Employer's Representative agree a programme for monthly inspections and make good/replace the coverings as may be required.

### 7.2.11 REMEDIAL WORKS

As a rule, remedial works to polyester powder coated aluminium external surfaces shall not be permitted. Where rectification is permitted to internal surfaces, full frame elements shall be coated. Spot repairs shall not be permitted in any circumstances. Site rectification of damage shall be subject to the approval of the Employer's Representative and shall only be permitted subject to the submission and approval of a specification and method statement endorsed by the powder manufacturer. The rectification of damage shall not invalidate the coating warranty. All remedial works shall be subject to trials and rejections and shall be at the discretion of the Employer's Representative. The Employer's Representative shall keep accepted trial samples as control samples. Repair record sheets including elevations indicating coated locations shall

be logged by the Specialist Façade Subcontractor and submitted to the Employer's Representative on completion of the works together with the coating Warranty documents.

#### 7.2.12 MAINTENANCE

The Specialist Façade Subcontractor shall provide comprehensive instructions for the maintenance of the coating. He shall ensure that the recommendations have been endorsed by the powder manufacturer and that, when applied as specified, they shall fulfil the requirements of the coating Warranty.

The recommendations shall include, but not be limited to the following:

1. Frequency of washing.
2. Solutions/detergents to be used and recommended dilution levels.
3. Type of cleaning materials.
4. Recommendations (if any) for deep cleaning processes (including solutions/compounds etc.) and their frequency.

#### 7.3 ANODISING ALUMINIUM

##### 7.3.1 GENERAL

Anodic oxidation of wrought aluminium shall comply with the minimum requirements of BS3987. The anodising shall be carried out by an Anodiser subject to the approval of the Employer's Representative. The same Anodiser shall be used for the duration of the Works. The Anodiser shall operate an ISO 9001 approved quality assurance system.

##### 7.3.2 MATERIALS

Materials shall comply with Appendix C of BS 33987. Sheet material shall be Alcoa J57S or equivalent grade.

##### 7.3.3 SIGNIFICANT SURFACES

All visible surfaces and other surfaces exposed to the external environmental conditions shall be deemed to be significant surfaces. These shall include any drained and ventilated cavities and pressure equalisation chambers.

The Anodiser shall note all significant surfaces on his drawings and provide the Employer's Representative with written confirmation from the Anodiser that full coverage is achieved.

##### 7.3.4 FABRICATION REQUIREMENTS

Care shall be taken to avoid scratching and damage to the anodic coatings during the fabrication. Where machining could leave exposed un-anodised surfaces, e.g. pivot hung ventilators, etc. or visible cut edges on sheet metalwork, the work shall be anodised after all machining. Where anodising is to be carried out after machining, satisfactory jiggings points shall be agreed between Anodiser and the Employer's Representative.

##### 7.3.5 ANODISING PROCESS

The anodic finish is intended to be natural anodised (non-coloured).

##### 7.3.6 CONTROL SAMPLES

Prior to commencement of the anodic coating, the Anodiser, shall submit to the Employer's Representative for acceptance, the following samples showing the variations in colour and texture:

1. 5 No. extrusions, typical for the Works, each 1200mm long processed in separate batches.
2. 5 No. sheets, typical for the Works, but each not less than 1200mm x 500mm, processed in separate batches.
3. Once approved and signed off by the Employer's Representative, the Anodiser shall label and sign each sample in five separate locations and arrange for the samples to be cut into five equal sized pieces. The sample pieces shall then be distributed as follows:
  1. The Subcontractor.
  2. The Employer's Representative (2 pieces).
  3. The Anodiser.
  4. The Independent Inspector.

The respective parties shall keep them for the duration of the Works. The Employer's Representative shall use these samples to agree or otherwise any disputed finishes.

##### 7.3.7 ACCEPTANCE TESTING

###### 7.3.7.1 THIRD-PARTY INSPECTION

The Anodiser shall make provision for the cost of a minimum of three acceptance inspections to be conducted by an independent inspection authority.

In the case of dispute between the Anodiser's results and those of the independent inspection authority, the results of the independent inspection authority shall take precedence.

#### 7.3.7.2 SAMPLING PROCEDURE

Sampling procedures and plans shall comply with BS 6001: Part 1 (ISO 2859/2), for general inspection Level 2, AQL = 1%. These inspections must be carried out at the finishing plant prior to fabrication.

#### 7.3.7.3 VISUAL APPEARANCE

The visual appearance of anodised aluminium shall comply with the requirements of BS3987/DIN 17611.

#### 7.3.7.4 SEALING QUALITY

Sealing of the anodic coating shall comply with BS 3897/DIN 17611. The adequacy of the seal for production purposes shall be assessed in accordance with BS 6161: Part 6.

#### 7.3.7.5 SURFACE ABRASION RESISTANCE

Surface abrasion resistance shall comply with BS 3987. In cases of dispute, the surface abrasion resistance shall be assessed using the method described in EN ISO 12373: Part 9. A minimum of 8 No. samples shall be selected at random from the batch of material suspected of low surface abrasion resistance. Anodic oxide films produced in sulphuric acid electrolytes shall have a wear index of not greater than 1.4.

#### 7.3.7.6 CERTIFICATION

Inspection certificates demonstrating that all relevant tests required by BS 3987 and this specification have been carried out and that the anodic finish complies with the minimum requirements in all respects, shall be submitted on request, to the Employer's Representative for review.

#### 7.3.8 TEMPORARY PROTECTION

All metal surfaces are vulnerable to damage during handling and installation or by subsequent site operations. These shall be fully protected for the duration of the Works.

Protective coverings shall be resistant to all weathers. Prior to installation, they shall be removed from areas inaccessible after installation. Where necessary, they shall be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Any protective tapes used in direct contact with the coating shall be low tack, self-adhesive type in white or any colour lighter than the coating to be covered. It shall be applied and removed in accordance with the recommendations of the powder manufacturer's guidelines.

#### 7.4 ICM PANEL FINISHES PVDF COATING

##### 7.4.1 GENERAL

Coil coated KYNAR 500 or HYLAR 5000 based Polyvinylidene Fluoride (PVDF) in conformance with the following general requirements of AAMA 2605.

All panels to be installed orientated in the same direction in order to maintain uniform appearance.

All panels to be from one PVDF coated coil or sequential coils. All panels for one elevation shall be from one pre-coated coil. Quality control records to be maintained confirming this.

##### 7.4.2 COLOUR

Standard colour from product range. To be confirmed by Employer's Representative (include metallic).

A colour match is defined within BS 2015 as 'paints are said to match if under certain conditions of illumination and viewing, no significant differences in their colour, can be detected'. The Employer's Representative shall be the sole arbiter regarding what is understood by 'significant' and what can be 'detected'. He shall be the sole arbiter regarding acceptance of colour, gloss and hue.

##### 7.4.2.1 COLOUR MEASUREMENT

When compared under natural diffuse daylight as described in ISO 3668: 2001, the finish on all visible surfaces shall match the accepted reference sample.

Colours shall be recorded as follows:

'XXXX' L\*X, a\*+/-Y, b\*+/-Z

L\* is a measurement of lightness of finish, from 0 (black) to 100 (white).

a\* is a measurement on the scale between red and green (positive for red, negative for green).

b\* is a measurement on the scale between yellow and blue (positive for yellow and negative for blue).

Allowable variation from prescribed colours:

'Grey' Maximum range of colour between reference panels  $0.28\Delta E$  (unless deemed unacceptable by the Employer's Representative during review of range samples).

Formula to be used for calculation of  $\Delta E$ .

#### 7.4.3 SERVICE LIFE

The minimum service life as defined in BS7543 shall not be less than 35 years.

#### 7.4.4 SIGNIFICANT SURFACES

All visible surfaces and other surfaces exposed to the external environmental conditions shall be deemed to be significant surfaces.

The Specialist Façade Subcontractor shall note all significant surfaces on his drawings and provide the Employer's Representative with written confirmation from the powder coating applicator that full coverage in accordance with this specification is achieved.

#### 7.4.5 FABRICATION REQUIREMENTS

Sample joints shall be submitted to the Employer's Representative for approval, prior to fabrication.

All welds, burrs and other edge machining shall be ground smooth.

The Specialist Façade Subcontractor shall ensure uniformity of colour, texture and gloss, on the completed elevations, between adjacent panels and/or components within the approved control samples.

#### 7.4.6 CONTROL SAMPLES

Colour control limits shall be submitted within 4 weeks of award of contract. Prior to the commencement of the procurement, the Specialist Façade Subcontractor shall, in conjunction with the Applicator, submit to the Employer's Representative for approval, the following samples showing the variations in colour and texture:

1. 2 No. sheets, typical for the works, but each not less than 1200mm x 1200mm showing the lower and upper range limits. Once approved and signed off, the Specialist Façade Subcontractor shall label and sign each sample in five separate locations and arrange for the samples to cut into five equal sizes. The samples shall then be distributed as follows:
2. The Contractor.
3. The Employer's Representative (2 No. samples).
4. The ICM panel fabricator.
5. The Independent Inspector (to be held by the Employer's Representative).

The respective parties shall keep these for the duration of the Works. The Employer's Representative shall use these samples to agree or otherwise any disputed finishes.

#### 7.4.7 PERFORMANCE CRITERIA FOR THE PVDF COATING

Hardness:

ASTM D 3363; HB minimum using Eagle Turquoise Pencil.

Impact:

Test method: ASTM D 2794; Gardner Variable Impact Tester with 15.9mm mandrel.

Coating shall withstand reverse impact of  $0.681 \text{ m}\cdot\text{kg}$  per mm substrate.

Coating shall adhere tightly to metal when subjected to #600 Scotch Tape pick-off test. Slight minute cracking permissible. No removal of film to substrate.

Adhesion:

Test Method: ASTM D 3359.

Coating shall not pick off when subjected to a grid of 11 cuts x 11 cuts, taped with #600 Scotch Tape.

Humidity Resistance:

Test Method: ASTM D 2247. No formation of blisters when subjected to condensing water fog at 100% relative humidity and  $37.8^\circ\text{C}$  for 4000 hours.

Salt Spray Resistance:

Test Method: ASTM B 117; Expose coating system to 4000 hours, using 5% NaCl solution. Corrosion creepage from scribe line: 1.6mm.

Minimum blister rating of 8 within the test specimen field.

Weather Exposure:

Outdoor: Ten-year exposure at  $45^\circ$  angle.

Maximum colour change of 5 Delta E units as calculated in accordance with ASTM D 2244.

Maximum chalk rating of 8 in accordance with ASTM D 4214.

No checking, crazing, adhesion loss.

Chemical Resistance:

ASTM D 1308 utilizing 10% Muriatic Acid for an exposure time of 15 minutes.

No loss of film adhesion or visual change when viewed by the unaided eye.

ASTM D 1308 utilizing 20% Sulfuric Acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by the unaided eye.

AAMA 2605 utilizing 70% reagent grade Nitric Acid vapour for an exposure time of 30 minutes.

Maximum colour change of 5 Delta E units as calculated in accordance with ASTM D 2244.

#### 7.4.8 ACCEPTANCE TESTING

As above, by manufacturer, verified by independent laboratories.

##### 7.4.8.1 THIRD-PARTY INSPECTION

No third-party inspections are proposed for ICM panel finishes. If there is a dispute, third-party inspections shall be carried out at the SFS cost to verify conformance with the Specification.

##### 7.4.8.2 APPLICATOR'S CERTIFICATE

The Specialist Façade Subcontractor shall provide the Employer's Representative with certificates which state that the finish complies with the requirements of this specification.

The Employer's Representative prior to the receipt of the Applicator's Certification cannot sign certificates of practical completion, or any other documentation accepting responsibility.

#### 7.4.9 TEMPORARY PROTECTION

All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations shall be fully protected for the duration of the works.

Protective coverings shall be resistant to all weathers and be removed from areas inaccessible after installation. They shall be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations.

Any protective tapes used in direct contact with the coating shall be a low tack, self-adhesive type in white or any colour lighter than the coating to be covered.

It shall be applied and removed in accordance with the recommendations of the ICM manufacturer guidelines. Protective film shall indicate direction of panel finish orientation.

Protective tapes shall not be kept in contact with coated surfaces for longer than 6 months.

Particular attention shall be paid to any wet applied weathering sealant. The covering shall allow for protection to the sealant during curing and shall not compromise the sealant's long term performance in any way.

Should the protective covering need to remain in place following installation, the Specialist Façade Subcontractor shall, in conjunction with the Employer's Representative agree a programme for monthly inspections and make good/replace the coverings as may be required.

#### 7.4.10 REMEDIAL WORKS

As a rule, remedial works to PVDF coated aluminium external surfaces shall not be permitted. Damaged panels shall be replaced with new.

Spot repairs shall not be permitted in any circumstances. Site rectification of damage (if permitted in extreme circumstances) shall be subject to the approval of the Employer's Representative and shall only be permitted subject to the submission and approval of a specification and method statement endorsed by the PVDF manufacturer. The rectification of damage shall not invalidate the coating warranty.

All remedial works shall be subject to trials and rejections and shall be at the discretion of the Employer's Representative. The Employer's Representative shall keep accepted trial samples as control samples. Repair record sheets including elevations indicating coated locations shall be logged by the Specialist Façade Subcontractor and submitted to the Employer's Representative on completion of the works together with the coating Warranty documents.

#### 7.4.11 MAINTENANCE

The Specialist Façade Subcontractor shall provide comprehensive instructions for the maintenance of the coating. He shall ensure that the recommendations have been endorsed by the powder manufacturer and that, when applied as specified, they shall fulfil the requirements of the coating Warranty.

The recommendations shall include, but not be limited to the following:

1. Frequency of washing
2. Solutions/detergents to be used and recommended dilution levels
3. Type of cleaning materials
4. Recommendations (if any) for deep cleaning processes (including solutions/compounds etc.) and their frequency

## 7.5 STEELWORK CORROSION PROTECTION – GALVANISING

The SFS shall inform the galvaniser of the proposed finishes to be applied after galvanising. The selected galvaniser shall be one with experience in galvanizing prior to powder coating and shall amend his procedures accordingly to ensure adhesion and durability of the completed finish.

Mild steel components shall be hot-dip galvanised after forming and drilling in accordance with EN 1461. The cutting, drilling or working of galvanized components shall not be permitted.

The galvaniser shall control dipping rates, temperatures, lifting methods and stacking procedures to ensure distortion, discolouration is minimised, and cracking due to differential expansion is avoided.

All galvanised components shall be subject to the following inspections to ensure freedom from distortion, discolouration, cracking and other imperfections.

1. 100% visual inspection.
2. Magnetic particle inspection of critical areas agreed with the independent coatings expert.

All inspections shall be recorded.

Any cracked components shall be rejected.

Cut ends or surface working to pre-galvanised sheet steel or any damage to galvanising (hot-dipped or otherwise) shall be repaired with zinc rich paint complying with BS4652.

## 7.6 STEELWORK CORROSION PROTECTION – PAINT

Note, paint finish shall only be applied to components that can be proven are not suitable for galvanising.

### 7.6.1 GENERAL

Painting shall follow the requirements of The National Structural Steelwork Specification for Building Construction (NSSSBC) Protective Treatment and Consulting Engineers (refer to relevant documentation). A single source complete paint system shall be used following requirements from ISO 12944 parts 1-8.

Surface treatment prior to painting shall be in accordance with BS 7079: Part A1.

## SECTION 08 44 13

**PART 8 – QUALITY CONTROL**

## 8.1 QUALITY PLAN

This section sets out the minimum requirements for the production of a Quality Plan for the Works. Much of the necessary documentation should already exist as part of the Specialist Façade Subcontractor's standard procedures and shall be supplemented where necessary by project specific procedures.

As required by the Schedule of Submissions an outline Quality Plan and a project specific Quality Plan shall be produced by the Specialist Façade Subcontractor following the principles and guidelines of EN ISO 9001 to demonstrate how quality management will be implemented from award of Contract through to Contract Completion.

## 8.2 QUALITY CONTROL PROCEDURES

The Specialist Façade Subcontractor shall develop inspection procedures, check lists and audits for monitoring the Works at the various stages.

A clear system shall be implemented to track information flow and check that work is being designed and installed to the most up-to-date revisions of specifications, drawings, interface drawings and this Contract Document.

The documented procedures shall cover but shall not necessarily be limited to the following:

1. Names and CV's of the Quality Manager and his team.
2. Quality assessment.
3. List of design development drawings required and the rate at which they will be produced.
4. Inspection procedures to be adopted in checking the Works.
5. Stages at which checklists will be used and samples of those checklists.
6. Statements on works procedures on the correct use of materials and components, both off site and on site.
7. List of product information with latest revisions.
8. Trade contractors appointed by the Specialist Façade Subcontractor that are involved in the Works.
9. The trade contractor's quality systems and details of their checklists.
10. Design, procurement, material checking, fabrication, storage, handling, transport and protection requirements.
11. Procedure for checking compliance with the Contract Documents and with accepted good practice.
12. Procedure for registering and reporting non-compliance.
13. Procedure for ensuring that non-compliance do not recur.
14. Calibration records of measuring equipment.
15. Certification that the Works are considered by the Specialist Façade Subcontractor to be complete and are ready for inspection by the Employer's Representative Employer's Representative.
16. Checklist register to ensure that all items have been inspected by the Specialist Façade Subcontractor and non-compliance discharged.
17. Protection of work in progress and work completed, including primary brackets, seals and fire stops.
18. Compliance with the requirements of the Health & Safety Regulations. During fabrication, checklists shall include inspection requirements for all components and finishes that cannot be inspected at later stages in manufacture, assembly, or erection of components.  
During erection, checklists shall include such items as survey spot checks of primary brackets, condition of components and assemblies and finishes, joint cleaning, backer rod and sealant installation, and firestopping.

Completed quality checklists shall accompany the components at all stages of production up to the final erection on site and be available for inspection at any stage.

The Specialist Façade Subcontractor shall keep full records of all quality management documents for a period not less than twelve years from Practical Completion. Copies of the quality management documents shall be included in the Operations and Maintenance manual as a record of the as-built works.

Detailed method statements as referred to in this Contract Document shall be required before the work commences.

## SECTION 08 44 13

**PART 9 – FABRICATION**

## 9.1 GENERAL

As required by the Schedule of Submissions, the Specialist Façade Subcontractor shall prepare general arrangement, component and assembly drawings and method statements and shall submit them to the Employer's Representative for review. The drawing review procedure is described in the Contract Documents. The Works shall be fabricated in accordance with these drawings and method statements, modified as necessary to meet the requirements of the Contract Documents. The Specialist Façade Subcontractor's fabrication team shall be involved with the design development.

Materials delivered to the Specialist Façade Subcontractor's works shall have supporting documentation verifying compliance with this Contract Document. Methods used in the fabrication shall be selected to achieve the specified performance. Methods used shall be based upon the use of suitable equipment and experienced operatives.

The assembly of components shall be carried out in a factory environment to the extent that it is possible to do this.

Components shall be checked by the Specialist Façade Subcontractor for compliance with drawings and method statements that have been reviewed by the Employer's Representative, prior to assembly in accordance with his quality procedures.

No modification or adaptation of the reviewed drawings and method statements shall be undertaken without the written consent of the Employer's Representative. All changes shall be recorded on a master set of documents and shall be included in the Operations and Maintenance manual as a record of the as-built works.

## 9.2 ASSEMBLY

## 9.2.1 FRAMEWORK

Grinding, cutting and shaping of metals shall be carried out using tools which will not contaminate them with particles which could stain or corrode them.

Joints shall be accurately formed without lipping or offsets in visible surfaces unless designed otherwise. Other joints shall be rigidly secured to prevent all but designed movement, unless shown otherwise.

Metals shall be welded in accordance with the relevant standards using methods to avoid distortion. The type, size and spacing of welds shall be shown on drawings and reviewed by the Employer's Representative, prior to fabrication.

Welds shall be fully bonded throughout their length without holes, inclusions, cracks or porosity so that the long term performance is not compromised and the welds are strong enough for the design requirements. The welds shall be ground smooth and flush with the adjoining surfaces where visible or impinging on other work. Site welding shall not be carried out. The completed welded construction shall be finished to prevent corrosion. All welds shall be cleaned as necessary to ensure the durability of the connections.

## 9.2.2 MILD STEEL FOR HOT DIP GALVANISING

Mild steel cut or shaped by either flame cutting or Plasma cutting shall be to procedures agreed by the Employer's Representative. These procedures shall demonstrate that the surface hardness is less than 270 Hv10.

Random inspection of the steel shall be required to ensure that the hardness level is not exceeded. Alternatively, all cut edges shall be surface dressed to remove hardened material.

All punched holes shall be undersized by 1.0mm and be reamed to the finished size.

All welding procedures and welding procedure specifications shall limit the hardness in the weld, parent metal or heat affected zone to less than 270 Hv 10.

Following pickling operations, the steel shall be held at more than 100 deg C to ensure a uniform temperature, either prior to, or after fluxing.

## 9.2.3 CUTTING, DRILLING AND MILLING

Arc cutting and acetylene gas cutting shall not be used.

## 9.2.4 PRESSING AND FOLDING

The folding and forming of aluminium sheet shall be carried out over dies or mandrels with the minimum radii recommended by the Aluminium Federation in such publications as The Properties of Aluminium and Its Alloys and The Designer's Guide to rolled Aluminium, Part 2. Trial bends shall be made on scrap material of the alloy, temper and thickness being used to ensure that it is not cracked, torn, unevenly stretched or separated at grain boundaries.

### 9.2.5 WELDING OF ALUMINIUM

Welding procedures shall comply with EN 288-4.

Welders shall be certified to EN 287.

Welding shall comply with EN 1011-4.

Welding shall be tested in accordance with BS 3451, EN 895, EN 910.

All stud welding shall be by the capacitor discharge process on freshly cleaned, degreased and oxide-free base metal shielded with argon gas, 99.95% pure, in accordance with Recommended Practice for Stud Welding by the American Welding Society.

### 9.2.6 WELDING OF STEELS

Welding procedures shall comply with EN 288-3.

Welders shall be certified to EN 287.

Welding of carbon manganese steels shall comply with EN 1011-2.

Welding of stainless steels shall comply with EN 1011-3.

Testing of welds shall comply with the National Structural Steelwork Specification, 3rd Edition.

## 9.3 SEALANT APPLICATION

### 9.3.1 SEALANT APPLICATION (NON-STRUCTURAL)

Ratio of seals shall be 1:2 or as recommended by the sealant manufacturer.

Sealant shall be applied to clean surfaces, primed as necessary, in accordance with the manufacturer's recommendations and procedures following adhesion and application tests. Conditions of application and cure shall be conducive to producing satisfactory results and avoid undue stress in uncured material.

Quality control adhesion tests shall be carried out throughout the period of manufacture to monitor the effectiveness of the material and application techniques.

Sealant shall be applied over bond breakers/backer rods, set into the joint to control the depth of sealant and to prevent three-sided adhesion.

Backing rods shall be selected and used strictly in accordance with the sealant manufacturers' recommendations.

## 9.4 GLASS

### 9.4.1 PREPARING PANES OF GLASS

Annealed glass panes, including those for insulated glazed units, shall be cut to size in the factory by scoring to produce clean cut edges. These edges shall not be dressed, worked or otherwise modified.

The edges of all panes and insulated glazed units shall be inspected during processing and before and after installation in their frames. Any edges with defects likely to initiate cracks in service including feather (shark's teeth) or whisker (serration's) deeper than half the thickness' of the pane, vents (flake chips) greater than 6mm across, or impact damage shall not be incorporated in the Works.

### 9.4.2 PREPARING INSULATED GLAZED UNITS

All insulated glazing is to be hermetically sealed insulated units to comply with EN 1279 (all parts) and have a design life of at least 25 years. The insulating glass unit manufacturer shall be registered to BS 5750 and hold a Kite Mark licence for all of its units (or similar approved ISO 9000 procedures and CE Marking). He shall be independently audited for compliance with EN1279 (all relevant parts).

The spacers separating the panes of glass shall have a black finish and shall have adequate rigidity for their purpose (including during the manufacturing, transport and installation stages). They shall be specifically designed to accommodate the seal and contain desiccant, allowing both to operate at maximum efficiency.

Warm edge technology spacers may be offered to achieve the required U values.

All bent edge spacers shall be limited to a maximum three joints in any one assembly. Spacer pieces shall not be less than 200mm in length. Joints shall not be allowed within 50mm of any corner.

The solar control coating (where applicable) shall be uniformly edge deleted or masked to ensure it does not overlap the primary polyisobutylene seal completely covering it. A minimum of 2mm of primary seal shall be in direct contact with the un-coated glass at all times around the perimeter of the glass.

Particular care shall be taken where the perimeter primary and secondary seals are exposed (visible). In this case it is required that NO coating residue is visible.

This shall be recorded on quality control samples prior to going into mass manufacture.

In areas where edge deletion exceeds 35mm from the glass edge, it shall not be done by grinding wheel unless accepted in quality control samples by the Employer's Representative. In this case coating should be carried out after application of ceramic ink (example: stepped edge units).

The units shall have and a secondary two part structural silicone seal extending around the perimeter of the insulated glazed units.

All breather/feeder tubes shall be nipped closed.

The units shall not employ edge tape. The edges shall be finished in a way which permits visual inspection of the glass edge, edge seals and the positions of the spacers.

BSI kitemarks and /or manufacturers' logos shall be sized as small as possible.

They shall be located in the bottom left hand corner of the insulated glazed units when viewed from the inside to the outside. Inner and outer lights shall be labelled to indicate construction of each (including annealed glass). Prior to going into mass-manufacture, the Specialist Façade Subcontractor shall provide samples of glass with propose stamps. These shall include UV ink marking of heat soak tested glass.

Spacer bars shall follow the line of the perimeter of the glass with equal dimension on all sides or as shown on the Specialist Façade Subcontractor's drawings. Spacer bars shall have the following straightness:  $\pm 1.0$  mm on length of spacer.

## 9.5 GASKETS

Gaskets shall be jointed as per the relevant system hand-book and applicable weather performance test reports. Gaskets shall not be jointed by bonding with adhesive and are not accepted as a substitute for moulded frame gaskets if the tested system used vulcanised ring gaskets. In the event that adhesive bonded joints are required to be formed, this shall be brought to the attention of the Employer's Representative for review before such work is carried out.

All gasket frames should be normally manufactured to a small but predetermined oversize tolerance, to ensure that when seated into position, the lineal lengths and corners of the gaskets are in slight compression.

Gaskets shall be installed in accordance with the manufacturer's recommendations and utilising the correct tools.

## 9.6 FABRICATION TOLERANCES

### 9.6.1 FRAMEWORK, INCLUDING LOUVRES AND BRISE SOLEIL

The maximum allowable tolerances for all framework shall be:

$\pm 1.0$  mm on length on profiles.

$\pm 1.0$  mm on straightness of profiles.

$\pm 1.0$  mm on straightness of carrier frames.

### 9.6.2 METAL PANELS INCLUDING PARAPETS

The maximum allowable tolerances for metal panels shall be as follows:

1. Panel Bow: 0.1% of panel minimum dimension in width and length up to 2.0 mm maximum.
2. Width or length: 0.8 mm up to 1200 mm 1.6 mm from 1200 mm to 3660 mm.
3. Squareness: 3 mm difference of diagonals for panels up to 1200 mm. (up to 1000 mm width). 4mm difference of diagonals for panels from 1200 mm to 3000 mm (up to 1500 mm width).
4. Camber: 0.8 mm up to 1200 mm 1.6 mm from 1200 mm to 3660 mm.

The Specialist Façade Subcontractor shall submit a full size quality control sample of each metal panel size prior to mass manufacture to set the maximum allowable tolerances. Where the quality control sample is better than the specified tolerances, its measurements shall form the maximum allowable tolerances in the Works. Quality control samples that fail to meet the design intent to the satisfaction of the Employer's Representative or fail to achieve the tolerances specified shall be rejected and additional samples shall be provided. Samples shall be presented in the required orientation to best demonstrate how it will appear in the Works. The Subcontractor shall ensure all components are measured and that those measurements are recorded in an auditable manner confirming compliance with the tolerances specified and achieved by the quality control samples.

### 9.6.3 GLAZING

The allowable tolerances on individual panes of glass shall be:

1.  $\pm 2.0$  mm on height and width.
2.  $\pm 1.0$  mm on straightness of edges.
3. Maximum overall bow measured edge to edge (deviation from design curve or flat surface) (Total) - (L/500 measured along the internal surface of the glass, and design curve template) up to a maximum of 5mm.

The maximum allowable tolerances on flat insulated glazed units shall be those given in this Specification and EN1279.

#### 9.6.4 FRAMES BONDED TO GLAZING (INCLUDING SPACER BARS)

The sizes of an assembled frame shall be within  $\pm 1$ mm from the work sizes and the maximum difference between the diagonals of the assembled frame shall be 4mm.

For flush joints formed by mechanical means, any in-plane deviation shall be within the tolerance limits set by the extrusion tolerances given in EN 573, EN 755 and EN 12020.

#### 9.7 MATERIAL PROTECTION

Materials, assembled units, elements of framing and all components shall be protected in such a manner that will prevent damage, distortion, uneven weathering or degradation under normal conditions of handling, storage and installation. Particular attention shall be given to the protection of edges, projecting features, corners and other vulnerable areas.

The Specialist Façade Subcontractor shall allow for provision of tape fully covering all aluminium finishes. He shall include provision of protective Corex sheeting or similar robust covering to glass and metal to a height of 2m above finished floor. The Subcontractor shall be responsible for maintaining and replacing such protection as is deemed necessary (not less than noted above) for the duration of the project until formal hand over to the Contractor. At hand-over, he shall remove all protection, clean down (full clean-down to finished standard) and present the Works for inspection. Any damaged materials shall be dealt with as identified in this Specification.

The Specialist Façade Subcontractor shall produce minimum 2% extra of each façade type (or more where he sees fit) as spares for replacement of components damaged during the contract Works. Where these spares have not been used, they shall be offered free issue to the Employer's Representative as spares. The Employer's Representative may request additional spares as he deems are required.

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**PART 10 – HANDLING AND STORAGE**

## 10.1 GENERAL

The Specialist Façade Subcontractor shall provide a method statement detailing the proposed methods of storage and handling, including transportation. This shall clearly demonstrate that all possible steps have been taken to minimise the risk of damage to fabricated panels.

The method statement shall include:

1. Details of manufacturer's requirements for the correct storage of materials and components, in the factory and on-site prior to erection, and protection at all times.
2. Details of temporary support arrangements for the assemblies, both on and off site.
3. Details of lifting arrangements (including structural calculations verifying structural adequacy for DGU elements such as spacer bars and primary seal between spacer bar and glass during lifting, storage, transportation and installation).
4. Transportation arrangements:

Materials, assembled units, elements of framing and all components of the permanent Works shall be protected and stored in such a manner that will prevent damage, distortion, uneven weathering or degradation.

All elements and components shall be clearly labelled for identification and traceability.

Inspection shall be undertaken in line with the agreed quality procedures for elements and components prior to their use. All damage shall be recorded and remedial procedures agreed with the Employer's Representative prior to incorporation into the Works.

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**PART 11 – INSTALLATION**

## 11.1 GENERAL

## 11.1.1 DOCUMENTS

As required by the Schedule of Submissions, the Specialist Façade Subcontractor shall prepare installation drawings and method statements and shall submit them to the Employer's Representative for review. The drawing review procedure is described in the Contract Documents. The Works shall be installed in accordance with the reviewed drawings and method statements, modified as necessary to meet the requirements of the Contract Documents.

Methods used in the installation of the Works shall be selected to achieve the specified performance. The equipment and operatives employed in all stages of installation shall be appropriate to the methods adopted.

The method statement shall set out the Specialist Façade Subcontractor's procedures including programme, sequence of erection, temporary works, dealing with adverse weather conditions, tools and plant, ancillary materials, labour, protection, co-ordination with other elements of work, and regular inspections.

Installation drawings, method statements and quality control procedures shall be supplied to the site installation team. The Specialist Façade Subcontractor shall co-ordinate between the site installation team and the works suppliers and his own designers and site staff so that all those parties are made aware of the important items to be checked during installation.

The installation drawings, method statements and procedures shall detail all the elements used to construct the Works and shall clearly describe all operations including the following:

1. Setting out and control points.
2. Cross reference to the identification of elements.
3. Details of isolation and packing.
4. All joints requiring sealant together with details of cleaning and, if required, priming of surfaces.
5. Details of position, type and size of backing rods and bond-release tapes etc.
6. The tolerances to be achieved in the location of elements and the alignment of joints.
7. All fixings requiring specific torque.
8. Details of equipment necessary to lift elements and components onto the building and to hold, line and level them once they have been positioned on the building.
9. Details of points that are susceptible to damage or should not be loaded during installation.
10. Details of protection.
11. Position of all hidden fixings.
12. How all Health & Safety requirements are incorporated into the installation process.

No modification or adaptation of the agreed drawings and method statements shall be undertaken without the prior agreement of the Employer's Representative. All changes shall be recorded on a master set of documents and shall be included in the Operations and Maintenance manual as a record of the as-built works.

## 11.1.2 SITE WORK

The Specialist Façade Subcontractor shall employ only competent experienced installers to carry out the Works. He shall provide and maintain records to demonstrate his employees experience and all related training.

The Works shall be installed to the dimensions indicated with the permissible deviations estimated by the Specialist Façade Subcontractor and marked on his drawings. These permissible deviations shall be confirmed to the Employer's Representative by the Specialist Façade Subcontractor during his detailed design development stage and be appropriate for the materials and methods employed to achieve the project requirements for appearance and fit as specified in the Contract Documents.

As installation proceeds, the Specialist Façade Subcontractor shall check the work and shall record all non-compliance. Remedial proposals shall be reviewed and agreed with the Employer's Representative as soon as possible after the problem has been identified.

The Specialist Façade Subcontractor shall not cut, drill or otherwise alter any work without review by the Employer's Representative.

## 11.1.3 ON-SITE CONTROL SAMPLES

The standard of workmanship for the Works shall be to the standard established by the reviewed off-site and on-site quality control samples. Until the Employer's Representative has accepted the control samples, the Specialist Façade Subcontractor proceeds with further installation work at his own risk. Upon acceptance, the onsite control samples shall remain as part of the Works.

The Employer's Representative shall reject all workmanship that falls below the accepted standard.

## 11.2 TOLERANCES

### 11.2.1 BUILDING FRAME TOLERANCES

The Specialist Façade Subcontractor shall establish the anticipated tolerances for the building frame and shall allow for these tolerances in the design of fixings and components such that the Works are always within the tolerances specified herein.

The Specialist Façade Subcontractor shall be responsible for obtaining any further tolerance information he may require having taken into account all criteria which in his specialist knowledge are relevant to the design and installation the Works.

### 11.2.2 SITE SURVEY

The Specialist Façade Subcontractor shall check the position of all elements of the building structure and other work that interfaces with the Works during the Specialist Façade Subcontractor's detailed design development period to verify their compliance with the Contract Documents. He shall do this by undertaking a line and level survey of the preceding elements of work including the details of points of attachments for the primary brackets where appropriate. He shall do this as soon as possible and shall submit the results to the Employer's Representative without delay.

Should the Specialist Façade Subcontractor find the preceding elements of work including any prepared fixing points to be outside the tolerances he anticipated and allowed for, he shall inform and review with the Employer's Representative his proposed remedial action.

### 11.2.3 ACCURACY OF ERECTION

The Works shall be installed to the following permitted deviations (non accumulative):

1. Line:  $\pm 2$  mm in any one storey height, or structural bay width.
2. Level:  $\pm 2$  mm in any one structural bay.
3. Plumb:  $\pm 2$  mm in any one storey height.
4. Plane:  $\pm 2$  mm in any one storey height or structural bay width.
5. Intersection:  $\pm 2$  mm in alignment in any direction between any two adjoining panels, at a 4-way intersection of panels.

### 11.2.4 ACCURACY OF JUNCTIONS BETWEEN COMPONENTS

Joints between components shall be constructed to the following permitted deviations:

1. Within the length of any joint (including in line continuations across transverse joints) the greatest width shall not exceed the least width by more than 25%. Any variation shall be evenly distributed with no sudden changes.
2. The offset end elevation between nominally in-line edges across a transverse joint shall be not more than 15% of the width of the transverse joint.
3. The offset in plan or section between flat faces of adjacent panels across any joint shall not be more than 15% of the width of the joint.

## 11.3 FIXINGS

Fixings including primary fixings to the building structure shall be installed in accordance with the fixing manufacturer's recommendations and required procedures, where necessary following site trials and tests. The details of primary fixings including the following shall be checked and recorded:

1. Type of proprietary fixings, their size and location.
2. Embedment, spacing and edge distances.
3. Torque levels.
4. Locking washers or nuts and engagement of serrated washers.
5. Isolation of dissimilar metals and of mill finish aluminium from cementitious material in wet environment.
6. Whether the fixing was tested or not. If tested, results of test.

For all bolt assemblies the strength grade combination of bolts/nuts/washers shall be as prescribed or recommended in the relevant British Standard.

The Specialist Façade Subcontractor shall secure all nuts used in connections to prevent loosening during the life of the Building.

The length of bolt shall be such that at least one clear thread shows above the nut after tightening, and at least one thread plus the thread run out shall be clear between the nut and the unthreaded shank of the bolt.

Where site drilling, cutting, grinding etc. is carried out all swarf shall be removed and all surfaces left clean.

## 11.4 GLASS

### 11.4.1 GENERAL

Glazing shall be carried out in accordance with manufacturer's recommendations, which shall take into account the recommendations of the Glass and Glazing Federation, and the requirements of BS 6262, and BS 8000-7.

Setting blocks and anti-walk devices shall be installed in accordance with the requirements of BS 6262, modified where noted in this specification.

It is envisaged that large panels of glass will be gravity supported in locations outside those described in BS 6262 and BS 8200. The Specialist Façade Subcontractor shall provide calculations to justify the support conditions.

No grinding or welding shall be permitted within 10m of unprotected glass.

### 11.4.2 VISUAL ACCEPTANCE CRITERIA

When viewed at 1000mm from the finished glazing and at any angle or direction:

1. Visible scratches, white scars and sleeks shall be deemed unacceptable.
2. Visible bubbles and inclusions shall be deemed unacceptable.
3. When viewed at 1m, visible bubbles less than 300mm apart shall be deemed unacceptable.
4. Visible scratches and sleeks shall be deemed unacceptable.
5. Colour of glass panels shall be uniform across an entire elevation and an individual panel.
6. Optical distortion in excess of that demonstrated by the off-site quality control samples and mock-ups

In addition to the above points, External laminated low iron screens shall have minimal visual distortion when viewed from 90 degrees at 1m distance, moving around to viewing from 30 degrees while viewing through the glass. The Employer's Representative shall be the sole arbiter regarding the acceptability of any distortion in the view through the glass.

### 11.5 VISUAL ACCEPTANCE CRITERIA (INSTALLED WORKS)

The Employer's Representative shall be the sole arbiter regarding the visual acceptance of the installed Works. Viewing shall be for minimum 5 minutes per panel in natural light including direct sun-light:

1. When viewed at 2m from the finished glazing (and metal cladding) and at any angle or direction from perpendicular, through to 30 degrees from the façade face:  
Visible scratches, white scars and sleeks shall be deemed unacceptable.  
Visible bubbles, ripples, pimples and inclusions shall be deemed unacceptable.  
When viewed at 2m, visible bubbles less than 300mm apart shall be deemed unacceptable.  
Visible scratches and sleeks shall be deemed unacceptable.  
Optical distortion in excess of that demonstrated in off-site quality control mock-ups and samples shall not be accepted. If no samples were submitted, the Specialist Façade Subcontractor shall ensure no optical distortion occurs.  
Colour of glass panels shall be uniform across an entire elevation and across a single panel.
2. When viewed at 2m from the finished opaque cladding (including soffits) at any angle or direction from perpendicular, through to 30 degrees from the cladding face:  
Visible scratches shall be deemed unacceptable.  
Visible bubbles, ripples, pimples and inclusions shall be deemed unacceptable.  
The panel surface shall appear flat from edge to edge in all conditions including direct sunlight. At 15 degrees Celsius surface and air temperature in a shaded location the panel surface shall be measured and confirmed to deviate less than 2mm from a straight edge. Straight edge to be minimum 1.5m long held up against the panel surface.  
Surface deformation such as oil-canning shall not result in visible rippling or bowing of the panel. Panel retention systems and stiffener application shall be designed to minimise this phenomenon and prevent locking in of stresses (see off-site quality control samples for initial quality assurance).  
Colour, hue, and gloss level of panels shall be uniform across an entire elevation and across a single panel.

### 11.6 GASKETS

Gaskets shall be installed as described elsewhere in this Contract Document.

### 11.7 INSULATION

Insulation shall be installed as shown on the Specialist Façade Subcontractor's drawings in accordance with manufacturer's recommendations. It shall be held in place by non-ferrous fixings mechanically attached to the supporting components.

Installations relying upon adhesives only shall not be permitted. Where mechanical fixings pass through waterproof membranes or vapour barriers, they shall be properly sealed to the waterproof membranes or vapour barriers.

The method of attachment to the supporting components shall be selected to eliminate the risk of bulging, sagging, delamination or detachment of the insulation. It shall be installed so that there are no gaps or lips between individual pieces of insulation or between insulation and any penetrations through the insulation.

#### 11.8 WATERPROOFING MEMBRANES

Membranes shall be fixed mechanically and with adhesives to the backing components. They shall be formed into shapes compatible with the building interfaces. They shall be sealed at all joints, and fixing penetrations.

The closures of junctions shall be formed of the membrane, on its own for narrow gaps and in combination with aluminium alloy sheet for wider gaps where support is required to prevent flapping under wind loading.

All joints between membranes shall be made by gluing and clamping them together where they are supported by a firm substrate and by gluing, vulcanising, solvent welding or heat welding them together where they are unsupported along the line of the joint.

Aprons and collars around windows and glazed walls shall be made completely continuous by gluing, vulcanising, solvent welding or heat welding the joints between their various segments.

The membranes shall be attached to the supporting components by sealing and clamping them to the supporting components. The clamps shall be sufficiently stiff and shall be fixed with fasteners sufficiently close together to maintain a complete seal and sufficiently strong to resist any design wind load on the barrier.

In all cases membranes shall be laid up in a manner to ensure natural drainage preventing ponding and preventing top edges of membrane from being exposed.

#### 11.9 FINISHES

Surface areas likely to be damaged during installation or by other Contractors shall be fully protected until completion of all work in the area of the installation.

If during installation any damage does occur, this shall be rectified by the Specialist Façade Subcontractor, progressively and shall not be allowed to accumulate. The Specialist Façade Subcontractor shall report all damage and these reports together with the Specialist Façade Subcontractor's proposals for rectification, shall be submitted to the Employer's Representative for review.

Where significant surface damage occurs to cosmetic clip-on components, such components shall be removed and renewed.

#### 11.10 PROTECTION AND CLEANING

Protection from the following trades or operations shall provide specific protection from the anticipated hazards. In particular vulnerable coated surfaces, glass, metal edges, corners and features shall be protected internally and externally.

He shall include provision of protective Corex sheeting or similar robust covering to glass and metal to a height of 2m above finished floor. The Specialist Façade Subcontractor shall be responsible for maintaining and replacing such protection as is deemed necessary (not less than noted above) for the duration of the project until hand-over to the Contractor. At hand-over, he shall remove all protection, clean down and present the Works for inspection.

Any damaged materials shall be dealt with as identified in this Specification.

The Specialist Façade Subcontractor shall produce minimum 2% extra of each façade type (or more where he sees fit) as spares for replacement of components damaged during the contract Works. Where these spares have not been used, they shall be offered free issue to the Employer's Representative as spares. The Employer's Representative may request additional spares as he deems are required.

Unless agreed otherwise protection should remain in place until all work potentially damaging to the components or their finish has been undertaken.

Materials used for temporary protection shall be compatible with the surface and finishes. They shall be removed without detriment to the finish and the component suppliers and finishers shall approve methods for removal.

Removal of protection and cleaning of the Works shall be carried out on completion unless agreed otherwise.

## SECTION 08 44 13

**PART 12 – MAINTENANCE****12.1 OPERATIONS AND MAINTENANCE MANUAL**

The Specialist Façade Subcontractor shall produce an Operations and Maintenance manual for the Works. Two copies of the manual will be required. A draft copy of the proposed manual shall be submitted to the Employer's Representative not less than six weeks before the programmed date for Completion. The manual shall be developed in parallel with the design and shall include, but not be limited to, the following information:

1. The name, address and telephone number of each firm and/or Contractor involved in the supply or fabrication of materials, components, assemblies and finishes.
2. A clear and concise description of the construction used to form the various elements within the Works. It shall be set out in chapters dealing with each element in turn. Its contents shall be comprehensively tabulated and its text cross-referenced. It shall be illustrated with sketches and Trade Literature and shall refer to the 'as-built' drawings.
3. Copies of material, components and finishes certification and test reports as required by the Contract Documents.
4. A method statement showing the means of access to all parts of the Works with recommended safe loading for regular maintenance.
5. A method statement covering the procedures for replacement of damaged or otherwise defective materials or components, and materials and components that have a design life less than the design life of the Works and will therefore require replacement during its life. Provide confirmation of the proposed glass replacement strategy for each part of the Works. Include detailed recommendations of access strategies and lifting methodology including proposed machinery, working platforms and safety systems. To include detailed structural calculations and loading requirements.
6. Quality management record sheets including records of repairs to coatings.
7. Recommendations and procedures for inspections, routine maintenance, lubrication, cleaning, suitable cleaning agents and painting.
8. A full set of as-built construction drawings, updated to include any changes made up to the time of completion.
9. The terms and conditions of any Warranties. Note that all Warranties for finishes shall be valid for periods of one year between cleaning.
10. Following hand over of the Building at Completion, the Specialist Façade Subcontractor shall allow for providing an experienced member of staff to familiarize the Facilities Manager of the Building with the use of, and information contained within, the Operations and Maintenance manual.

**12.2 MAINTENANCE AND DEFECT RECORDS**

During the defects liability period (12 months from date of Practical Completion) the Specialist Façade Subcontractor shall maintain an auditable Defects Register.

He shall separately maintain a Maintenance Register.

The Defects register shall include, but is not limited to, the following information:

1. Reference numbers for ease of tracking each defect
2. Identification of the location of the defect, clearly indicated on A3 drawing giving grid referenced plan, section and elevation.
3. Identification of type of defect (e.g. failure of handle, leak, glass breakage etc.).
4. Date that defect was detected.
5. Dates of inspections of the defect and reports of findings (one per inspection).
6. Formal proposal for rectification of the defect (multiple proposals to be recorded if initial proposal is not successful).
7. Record of Employer's Representative and Contractor formal acceptance of 'a' - 'f' above (required prior to carrying out any remedial actions).
8. Record of inspection of remedial action and confirmation that the action has been successful in resolving the defect. Note, this statement shall include confirmation that the warranty and insurances for the completed works as provided at Practical Completion has not been compromised by the remedial actions, to be signed by the Specialist Façade Subcontractor and Contractor, countersigned (if accepted) by the Employer's Representative.

The Maintenance register shall include, but is not limited to, the following information:

1. Schedule for regular maintenance with identification of what actions are to be undertaken at each interval.
2. Sign-off sheet for regular maintenance confirming maintenance has been undertaken.
3. Identification of any un-planned maintenance that had to be undertaken (reference Defects Register number)

### 12.3 ACCESS OF CLEANING AND INSPECTION

Access for cleaning are envisaged as follows:

1. Cherry picker.
2. Long pole.
3. Temporary platform.

Note, roof areas shall require man-safe systems installed by others to interface with the façade construction. The Specialist Façade Subcontractor shall allow for interfacing constructions to allow safe maintenance of the Façades and roof areas.

The Specialist Façade Subcontractor in consultation with the Employer's Representative shall recommend methods and procedures to be utilised to allow inspection at the intervals stated in the Operations and Maintenance manual. This will allow systematic monitoring of the condition of the Works, assist in the prediction of the need for preventative maintenance and redecoration during the life of the Works, and inspection and testing of structural silicone glazing as required by this Contract Document.

### 12.4 LIMITATIONS

This Specification does not absolve the cladding Specialist Façade Subcontractors from their responsibilities as set out in the contract documentation relative to their works.

**END OF SECTION 08 44 13**

**SECTION 08 91 19 – FIXED LOUVRES****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. To be read with the Contract, Drawings, other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

- A. This section describes the Contractor's design, shop drawings, fabrication, finishing, installation, commissioning and warranting of framed metal louvres and true continuous line louvre screens to be inserted into various wall and roof constructions, as shown on the drawings, to include all required structural supports, concealed fixings, frames, flashings for the works as described herein and on the drawings.
- B. The Contractor shall test, design, source, supply, fabricate, draw up, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation to the approval of the Employer's Representative. To include all items necessary for full completion and finishing of the work not necessarily included.

**1.2.1 CONTRACTOR'S DESIGN OF THE LOUVRE SCREENS AND FRAMED INSTALLATIONS**

- A. This section describes the Contractor's design, drawings, fabrication, finishing and installation of all framed metal louvres and true continuous line louvre screens, incorporating all structural supports and concealed fixings, openings, finishing for the works as described herein and on the drawings.
- B. Section Includes but is not limited to:
1. Aluminium Louvre Screens, and Framed Louvres. All as shown on the drawings and in accordance with the requirements of the mechanical ventilation calculations.

**1.3 COMPONENTS**

- A. Metal Louvre Assembly: The Contractor shall supply and install the Framed Metal Louvres, attachment system components, miscellaneous metal framing, flashings, trims and all accessories necessary for a complete weathertight metal louvre system.

**1.3.1 COMPONENT/ELEMENT TYPES**

- EWL-001 – Polyester Powder Coated Louvre Screen (Roof Plant Screen)  
EWL-002 – Polyester Powder Coated Weather Louvre Panels  
EWL-003 – Polyester Powder Coated High Permeability Louvre Panels

**1.3.2 DEFINITIONS**

- A. Where the word 'Design' occurs in this document it will be described as 'Design\*'. The Asterisk implies that 'Under the design portion requirements of this specification the Contractor is requested to take the Design and apply their own manufacturers systems and materials performance data to comply with all criteria set out in this specification document and the design drawings'.

**1.4 PERFORMANCE REQUIREMENTS**

- A. General Performance: Metal louvre assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Comply with the general performance of Division 01 and the following specific performance requirements.

**1.4.1 SPECIFIC MOVEMENTS**

- The works shall withstand all movement of the structure under all design loads or combination of loads without damage or reduction in performance.  
Expansion and movement joints shall accommodate the appropriate range of movement.  
Refer to, and take account of the Movements and Tolerances information as defined within the project Documentation.

**1.4.2 SPECIFIC LIVE LOADS**

- The works shall be capable of accommodating the following specific live loads without any reduction in performance:

Horizontally applied loads acting on the surface of any component. The works shall sustain safely, without reduction in performance and without permanent deformation to any component, a static 500N load applied horizontally through a square of 100mm sides on any part of the framing.

A horizontal line load applied to the works, due to the occupants, in accordance with BS 6180 and EN 1991-1-1:2002 Eurocode 1. Actions on structures. General actions. Densities, self-weight, imposed loads for buildings.

#### 1.4.3 WIND LOADS

Wind loading shall be accommodated safely, without detriment to the overall design, structural integrity and performance of the works.

Design Wind Pressures: Refer to the Structural requirements.

Calculated pressure loads shall include the effect of internal air pressures within the building, taking into account the presence of significant openings, which might arise occasionally within the building enclosure.

#### 1.4.4 THERMAL MOVEMENT

All components shall resist thermal movement resulting from the maximum and minimum surface temperature differentials occurring. The design shall cater for all temporary and permanent conditions envisaged for the works.

The works shall be capable of accommodating changes in dimension and shape of its components resulting from the varying surface temperatures without any reduction in the specified performance.

Thermal movements shall not result in audible noise.

#### 1.4.5 MOISTURE MOVEMENT

The works shall withstand movement without permanent deformation or any reduction in the specified performance:

Due to changes in the moisture content of its components, resulting from variations in the moisture content of the air.

Due to the expansion of absorbed or retained moisture caused by freezing.

Caused by the flow of rainwater to the inside of the louvres.

#### 1.4.6 THERMAL PERFORMANCE REQUIREMENTS

Comply with the requirements of Technical Guidance / Approved Document Part L of the Building Regulations. Provide U-value calculations including condensation calculations to justify insulation and vapour barrier design.

#### 1.4.7 SOLAR PERFORMANCE REQUIREMENTS

Exposure to sunlight during the service life of the works shall not result in degradation of appearance or performance.

#### 1.4.8 AIR PERMEABILITY/ INFILTRATION

The works shall resist the passage of air such that its air leakage rates, if measured in accordance with EN 12153 shall not be exceeded in both the initial and repeat tests.

Air leakage through the works and at interface conditions shall accord with the requirements of Technical Guidance / Approved Document Part L of the Building Regulations.

#### 1.4.9 CONDENSATION

No condensation shall take place either on internal or external surfaces, or within the interstitial construction thickness of the works under the temperature and humidity conditions listed in clause.

#### 1.4.10 CAPILLARITY

Gaskets and seals shall be designed to incorporate capillarity breaks to prevent the ingress and entrapment of water between surfaces in continuous contact.

#### 1.4.11 WEATHER AND WATER PENETRATION RESISTANCE

The works, including flashings and junctions with adjacent components, shall be weatherproof and watertight under all conditions with full allowance made for fully deflections and other movements.

#### 1.4.12 ACOUSTIC: SOUND INSULATION

The works shall provide the sound insulation levels specified, which shall be achieved on site for each type, inclusive of all services penetrations and interfaces with other elements.

The Weighted Sound Reduction Index (R<sub>w</sub>) and the Apparent Weighted Sound Reduction Index (R'<sub>w</sub>) shall be defined according to EN ISO 717.

Refer to the Acoustic Consultant's Report.

#### 1.4.13 DURABILITY

The performance criteria shall be satisfied for the full design life of the works, as stated by the Specification, provided always that the maintenance has been carried out as specified.

Metal louvre blades / components shall not suffer bowing, dimpling, oil canning, sagging, pillowing, rippling, warp, abrupt transitions and other visual deformation or irregularity.

#### 1.4.14 IMPACT AND ABRASION RESISTANCE

Generally, surfaces shall be sufficiently hard to resist heavy impacts from hand-held objects without any noticeable change to the surface appearance. The works shall resist abrasion from cleaning methods and maintenance systems without any noticeable change in surface appearance.

Impact tests shall be carried out on all works assemblies adjacent to pedestrian areas in accordance with the recommendations of BS 8200. Tests shall conform to category B requirements.

The extent of any damage determined through testing shall be recorded and, where possible, quantified. Samples shall be submitted to the Employer's Representative.

Details of tests shall be provided to demonstrate the performance of materials and finishes in resisting abrasion from pedestrian traffic (hands, rings, luggage, cloth, shoes, etc.) and any other abrasion resulting from adjacent traffic movements.

#### 1.4.15 DEMOUNTABILITY

Elements of the works shall be individually and independently removable ensuring access for maintenance and/or replacement of panels in the event of damage.

The removal of louvres shall not affect the performance or safety of adjacent or any other part of the works.

#### 1.4.16 SPECIFIC FIRE PERFORMANCE REQUIREMENTS

Elements of the works shall be either non-combustible or not easily ignitable with low flame spread characteristics and shall not produce excessive quantities of smoke or toxic gases.

Surface spread of flame:

External areas shall meet unprotected limitations under requirement 'External Fire Spread' in Technical Guidance / Approved Document Part B of the Building Regulations.

All materials used internally and externally shall have a Class 0 surface spread of flame classification (unless otherwise specified) when tested in accordance with BS 476: Parts 6 and 7.

#### 1.4.17 FIRE AND SMOKE STOPPING

Provide all cavity barriers to meet the requirements of the Technical Guidance / Approved Document Part B of the Building Regulations.

Fire and smoke stops shall be positively fixed in position in such a manner that they will not become dislodged in the event of a fire.

#### 1.4.18 PRIMARY COMPONENTS

The following components shall be primary components:

- Framed Louvre Panels.
- True continuous line louvre screens.
- Primary Structural Framework.
- Support brackets.

#### 1.4.19 SECONDARY COMPONENTS

The following components shall be considered secondary components:

- Fixings.
- Gaskets.
- Flashings
- Frames

Secondary components shall be capable of replacement without progressive dismantling of the works.

#### 1.5 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

## DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT

Building Regulations 2010

## BRE

Information Paper 10/02 Metal cladding: Assessing the thermal performance of built up systems which use Z spacers. 2002

Information Paper 1/06 Assessing the effects of thermal bridging at junctions and around openings. 2006

Report 262 Thermal insulation: avoiding risks. 3rd edition. 2002

Report 443 Conventions for U-value calculations. 2006

Report 497 Conventions for calculating linear thermal transmittance and temperature factors. 2007

## IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

## BRITISH STANDARDS INSTITUTION

EN ISO 717-1:2013 Acoustics - Rating of sound insulation in buildings and of building elements. Airborne sound insulation.

EN ISO 6946:2007 Building components and building elements. Thermal resistance and thermal transmittance. Calculation method.

EN ISO 7010:2012 Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010:2011). +A5:2015

EN ISO 13788:2012 Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods (ISO 13788:2012).

EN ISO 14021:2001 Environmental labels and declarations - Self-declared environmental claims (Type II environmental labelling). + A1:2011 (Renumbered from BS ISO 14021:1999)

EN 485-2:2013 Aluminium and aluminium alloys - Sheet, strip and plate. Mechanical properties.

EN 508-1:2014 Roofing and cladding products from metal sheet - Specification for self-supporting of steel, aluminium or stainless steel sheet. Steel.

EN 508-2:2008 Roofing products from metal sheet. Specification for self-supporting products of steel, aluminium or stainless steel sheet. Aluminium. + Corrigendum 1

EN 508-3:2008 Roofing products from metal sheet. Specification for self-supporting products of steel, aluminium or stainless steel sheet. Stainless steel.

EN 573-3:2013 Aluminium and aluminium alloys - chemical composition and form of wrought products. Chemical composition and form of products.

EN 1013:2012 Light transmitting single skin profiled plastic sheets for internal and external roofs, walls and ceilings - Requirements and test methods. +A1:2014

EN 1090-2:2008 Execution of steel structures and aluminium structures. Technical requirements for steel structures. +A1:2011

EN 1991-1-3:2003 Eurocode 1. Actions on structures. General actions. Snow loads. + AMD 15509, Corrigendum March 2009

EN 10147:2000 Continuously hot-dip zinc coated structural steels strip and sheet. Technical delivery conditions.

EN 10214:1995 Continuously hot-dip zinc-aluminium (ZA) coated steel strip and sheet. Technical delivery conditions.

EN 10215:1995 Continuously hot-dip zinc aluminium (AZ) coated steel strip and sheet. Technical delivery conditions.

EN 10346:2009 Continuously hot-dip coated steel flat products. Technical delivery conditions.

BS 476-3:2004 Fire tests on building materials and structures. Classification and method of test for external fire exposure to roofs. + AMD 16169, AMD 16924

BS 476-7:1997 Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products, incorporating corrigendum No. 1

BS 1449-2:1983 Steel plate, sheet and strip. Specification for stainless and heat-resisting steel plate, sheet and strip. + AMD 4807, AMD 6646, AMD 8828, AMD 9648

BS 4800:2011 Schedule of paint colours for building purposes.

BS 5250:2011 Code of practice for control of condensation in buildings.

BS 5499-5:2002 Graphical symbols and signs. Safety signs, including fire safety signs. Signs with specific safety meanings.

BS 5821-3:1984 Methods for rating the sound insulation in buildings and of building elements. Method for rating the airborne sound insulation of facade elements and facades.

BS 5950-2:2001 Structural use of steelwork in building. Specification for materials, fabrication and erection. Rolled and welded sections.

BS 5950-7:1992 Structural use of steelwork in building. Specification for materials and workmanship: cold formed sections.

NA to EN 1991-1-3:2003:2005 UK National Annex to Eurocode 1. Actions on structures. General actions. Snow loads. + AMD 17170

## EUROPEAN COMMISSION

Regulation (EC) 305/2011/EU Laying down harmonised conditions for the marketing of construction products

FIRE PROTECTION ASSOCIATION

Design Guide for the Fire Protection of Buildings FPA design guide for the fire protection of buildings. Essential principles. 2nd edition. 2007

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)

Guide Choosing construction products: Guide to the recycled content of mainstream construction products. Version 4. 2008

## 1.6 ACTION SUBMITTALS

- A. **Manufacturer's Technical Product Data:** For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.  
Confirm production from lower embodied carbon aluminium using recycled content and provide data.
- B. **SHOP DRAWINGS:** Show fabrication and installation layouts of metal louvres; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.  
Distinguish between factory-, shop-, and field-assembled work.
1. **Accessories:** General arrangement drawings at a scale not less than 1:100. Include details of the following items, at a scale of not less than 1:10:
    2. Flashing and trim.
    3. Anchorage systems.
    4. Corner details.
    5. Door details, to include jambs, head and cill.
- C. **SAMPLES FOR INITIAL SELECTION:** For each type of metal louvre indicated with factory-applied colour finishes.
1. Include similar Samples of trim and accessories involving colour selection.
  2. Include manufacturer's colour charts consisting of strips of cured sealants showing the full range of colours available for each sealant exposed to view.
- D. **SAMPLES FOR VERIFICATION:** For each type of exposed finish required, prepared on Samples of size indicated below.
1. **Metal Louvres:** 300 mm long by actual louvre panel width. Include fasteners, battens, closures, and other metal louvre panel accessories.
  2. **Trim and Closures:** 300 mm long. Include fasteners and other exposed accessories.
  3. **Accessories:** 300 mm long Samples for each type of accessory.
- E. **Delegated-Design Submittal:** For metal louvre panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.7 INFORMATION SUBMITTALS

- A. **SCHEDULE OF ALL LOUVRES TO BE INSTALLED:**  
To include louvre dimensions, type of louvre, free standing screen or framed within wall construction.
- B. **COORDINATION DRAWINGS:** Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items. Show the following:
1. Louvre panels and attachments.
  2. Structural and Finished Framing.
  3. Wall-mounted items including, louvres.
- C. **QUALIFICATION DATA:** For Installer, professional engineer and testing agency.
- D. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- E. **Field quality-control reports.**
- F. **WARRANTIES:** Sample of special warranties.

## 1.8 METHOD STATEMENTS

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

## 1.9 CLOSEOUT SUBMITTALS

- A. **Maintenance Data:** For louvre panels to include in maintenance manuals.

### 1.10 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to NSAI, INAB, UKAS for testing indicated.
- C. Source Limitations: Obtain each type of louvre panel from single source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide metal louvre panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per BS 476.
  - 2. Intermediate-Scale Multi-storey Fire Test: Tested mock-up, representative of completed multi-storey wall assembly of which louvre panel is a part, complies with BS 8414-2:2015 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
- E. PROTOTYPE REQUIREMENTS:  
A prototype shall be provided as follows:  
A prototype comprising of 1 of each type of complete louvre panel/screen including method of fixing and finishing.  
BENCHMARK REQUIREMENTS:  
The following quality benchmarks shall be provided:  
1 of each type of complete louvre panel/screen including method of fixing and finishing in location to be agreed with the Employer's Representative.  
MOCK-UPS: Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mock-up of typical louvre panel assembly as shown on Drawings; including supports, attachments, and accessories.
  - 2. Conduct water spray test of mock-up of metal louvre panel assembly, testing for water penetration according to Technical Notes from CWCT.
  - 3. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Employer's Representative specifically approves such deviations in writing.
  - 4. Approved mock-ups may become part of the completed Work if undisturbed at time of Practical Completion.
- F. PREINSTALLATION CONFERENCE: Conduct conference at Project site.
  - 1. Meet Employer's Representative, employer's insurer if applicable, testing and inspecting agency representative, metal louvre Installer, metal louvre manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal louvre panels.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal louvre panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review flashings, special details, wall penetrations, openings, and condition of other construction that will affect metal louvre panels.
  - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 7. Review temporary protection requirements for metal louvre panel assembly during and after installation.
  - 8. Review louvre panel observation and repair procedures after metal louvre panel installation.

### 1.11 ENGINEER OF RECORD

The Engineer of Record must be currently registered within the jurisdiction of the project.

The Engineer of Record must be approved, authorized, and currently registered with the Institution of Engineers of Ireland (IEI), and have a minimum of five years' experience as registered Engineer.

The Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. The Engineer of Record must provide certified engineering calculations for:

The works described herein and on the drawings and associated requirements in accordance with UK and European codes.

**1.12 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, frames, metal louvre panels, and other manufactured items so as not to be damaged or deformed. Package metal louvre panels for protection during transportation and handling.
- B. Unload, store, and erect metal louvre panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal louvre panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal louvre panels to ensure dryness, with positive slope for drainage of water. Do not store metal louvre panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal louvre panels for period of metal louvre panel installation.

**1.13 PROJECT CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal louvre panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal louvre panel fabrication, and indicate measurements on Shop Drawings.

**1.14 COORDINATION**

- A. Coordinate metal louvre panel assemblies with rain drainage work, flashing, trim, and installation of channels, studs, soffits, and other adjoining work to provide a leak-proof, secure, and noncorrosive installation.

**1.15 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - Structural failures, including rupturing, cracking, or puncturing.
    - Deterioration of metals and other materials beyond normal weathering.
  2. Warranty Period: 20 years from date of Practical Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - Colour fading more than 5 Hunter units when tested according to ASTM D 2244.
    - Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Practical Completion.

**1.16 DECLARATION OF CONFORMANCE**

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
- The performance requirements for the project.
- The technical specifications standards described herein.

From July 2014 Structural steelwork and aluminium fell under the CPR and therefore requires DOPs and CE Marking to be affixed to show compliance with EN 1090-1.

**1.17 SINGLE SOURCE WARRANTY**

All components and 'build-up of components' shall be covered by a single source, insurance backed warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified.

All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions.

Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates.

Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Employer's Representative.

#### 1.18 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed in accordance with BS ISO 15686-5:2008 'Buildings and constructed assets. Service life planning. Life cycle costing'.
- B. The term 'Maintenance' shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.
- D. COMPONENT PARTS: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Employer's Representative must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.
- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.19 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Validation according to the Eco-Management and Audit System (EMAS).
  - 3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. Metal louvre panels and associated systems as designed, supplied and installed by a manufacturer regularly engaged in the design and production of such systems.
- C. Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work to include but not to be limited to, the following:  
Basis of Design Manufacturer:

QEF Limited, Dublin Road, Kilkenny, Republic of Ireland.

Tel: +353 (0)56 776 4910. Fax: +353 (0)56 776 1557: E-mail sales@qefltd.ie

Crossflow Ltd. Ireland, Unit 50 Hawthorn Road, Western Industrial Estate, Dublin 12

Tel: +353 (0)1 427 9300. Fax: +353 (0)1 427 9301. Email: enquiries@crossflow.ie

SECTION 08 91 19

**PART 2 – PRODUCTS**

2.0 LOUVRE TYPES

Standard louvre types for this project are as follows:

Louvre Type	EWL-001	EWL-002	EWL-003
% Open area	31%	52%	80%
Weather Classification	N/A	A3 @ 2m/s	N/A

EWL-001 – POLYESTER POWDER COATED LOUVRE SCREEN (ROOF PLANT SCREEN)

Product Ref: Crossflow/Levolux Ligniti XL140.

Material: Extruded Aluminium 6063 T6 to BS 1474

Fire Resistance Rating: Not fire-rated.

No of Banks: Single bank screening louvre.

Louvre Blade & Pitch: 1.6-2 mm thick aluminium Z- blade with 140mm pitch.

Rear Mounted Supports (Standard louvre): Vertical, full height aluminium mullions at max. 1800 mm centres. Blades spanning horizontally between vertical posts. Louvres may be provided with rear mounted blade supports that increase overall louvre depth depending on louvre size, assembly configuration or wind load.

Casement, mullions, blades and clips: Extruded aluminium alloy 6063 T6 to EN 755.

Certification: BSRIA Tested against the standard HEVAC test to EN 13030

Open area: 31%

Louvre Weather Class: N/A

Louvre Screen Height: Nominally 3000 mm. Refer to drawings.

Louvre System to include integrated aluminium louvred doors. Doors to incorporate the Levolux 140XL Louvred Blade System complete with Euro-profile mortice deadlock with single cylinder/thumb turn, gas stay and stainless steel pivot hinges, shoot bolt to top and bottom on double doors. All louvred corners are to be mitre cut.

Finish: Polyester powder coating: 60µ to BS 6496. RAL colour range.

Fixing: To sub-contractors details.



EWL-002 – POLYESTER POWDER COATED WEATHER LOUVRE PANELS

Product Ref: Crossflow/Levolux VLS HP50 (Alternative: QEF 50 HP)

Material: Extruded Aluminium 6063 T6 to BS 1474

Fire Resistance Rating: Not fire-rated.

No of Banks: Single bank.

Louvre Blade & Pitch: 1.6-2 mm thick aluminium contour blade at 45 degrees with 50mm pitch.

Rear Mounted Supports (Standard louvre): Vertical, full height aluminium mullions at max. 1200 mm centres. Blades spanning horizontally between vertical posts. Louvres may be provided with rear mounted blade supports that increase overall louvre depth depending on louvre size, assembly configuration or wind load. Expansion gaps need to be considered at 6mt maximum centres.

Integrated removable insect mesh.

Casement, mullions, blades and clips: Extruded aluminium alloy 6063 T6 to EN 755.

Certification: BSRIA Tested against the standard HEVAC test to EN 13030.

Open area: 52%

Louvre Weather Class: A3 at 2.0m/s

Louvre Screen Height: Refer to drawings.

Finish: Polyester powder coating: 60µ to BS 6496. RAL colour range.

Fixing: To sub-contractors details.

**EWL-003 – POLYESTER POWDER COATED HIGH PERMEABILITY LOUVRE PANELS**

Product Ref: Crossflow CLS 60.

Material: Extruded Aluminium 6063 T6 to BS 1474

Fire Resistance Rating: Not fire-rated.

No of Banks: Single bank.

Louvre Blade & Pitch: 1.6-2 mm thick aluminium Z- blade at 75 degrees with 60mm pitch.

Rear Mounted Supports (Standard louvre): Vertical, full height aluminium mullions at max. 1200 mm centres. Blades spanning horizontally between vertical posts. Louvres may be provided with rear mounted blade supports that increase overall louvre depth depending on louvre size, assembly configuration or wind load. Expansion gaps need to be considered at 6mt maximum centres.

Integrated removable insect mesh.

Casement, mullions, blades and clips: Extruded aluminium alloy 6063 T6 to EN 755.

Certification: BSRIA Tested against the standard HEVAC test to EN 13030.

Open area: 80%

Louvre Weather Class: N/A

Louvre Screen Height: Refer to drawings.

Louvre System to include integrated aluminium louvred doors. Doors to incorporate the Crossflow CLS60 Louvred Blade System complete with Euro-profile mortice deadlock with single cylinder/thumb turn, gas stay and stainless steel pivot hinges, shoot bolt to top and bottom on double doors. All louvred corners are to be mitre cut.

Finish: Polyester powder coating: 60µ to BS 6496. RAL colour range.

Fixing: To sub-contractors details.

**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design louvres, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvres shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louvre components, noise or metal fatigue caused by louvre-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.  
Wind Loads: Determine loads based on pressures as indicated on Drawings.
- C. Windborne-Debris-Impact Resistance: Louvres located within 9.1 m of grade shall pass enhanced-protection, large-missile testing requirements in EN 1991-1-4:2005+A1:2010 Eurocode 1. Actions on structures. General actions. Wind actions Test specimens shall be no smaller in width and length than louvres indicated for use on Project.
- D. Louvre Performance Ratings: Provide louvres complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to EN 13030:2001.

**2.2 MATERIALS**

- A. Aluminium Extrusions: EN AW 6063T6 to EN 755 -1 and -9.
- B. Aluminium Sheet: EN 485-1:2008+A1:2009 Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminium, use aluminium or 300 series stainless-steel fasteners.
  - 3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
  - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
  - 5. For colour-finished louvres, use fasteners with heads that match colour of louvres.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with BS 3416:1991.

**2.3 FABRICATION**

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louvre blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louvre manufacturer unless otherwise indicated or size of louvre assembly makes bolted connections between frame members necessary.

**2.4 ALUMINUM FINISHES**

- A. EN ISO 7599:2010 Anodizing of aluminium and its alloys. General specifications for anodic oxidation coatings on aluminium.  
Colour and Gloss: As selected by Employer's Representative via samples.

**2.5 GALVANIZED-STEEL SHEET FINISHES**

- A. Finish louvres after assembly.
- B. Surface Preparation: Clean surfaces with non petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair.
- C. Polyester Powder-Coat Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 0.05 mm according to EN 12206-2004 and BS 6497.
- D. EN ISO 7599:2010: Anodizing of aluminium and its alloys. General specifications for anodic oxidation coatings on aluminium.  
Colour and Gloss: As selected by Employer's Representative via samples.

## SECTION 08 91 19

**PART 3 – EXECUTION****3.1 INSTALLATION**

The louvre screens shall be installed on suitable upstands by the Contractor. The Contractor shall confirm with the Louvre Screen manufacturer, the performance requirements of the upstands for the full and complete installation of the louvre screens.

The works shall be erected plumb (or at the angles prescribed) and true in proper alignment and relation to established lines and grids as shown on the Working Drawings.

The erected system shall present true and accurate lines and flat planes. Deviations from lines, planes and verticality shall be limited to long wave formations of minimum wave length of 20m length with a rate of exchange not exceeding 1:1000, of 3mm. All the above shall be measured from a laser reference line.

Joins between louvres panels: The actual width of any joint shall not deviate from the nominal width by more than  $\pm 2\text{mm}$  or 10% of the joint width whichever is the lesser. Any variation shall be equally distributed with no sudden changes. The misalignment between joints shall not exceed 2mm.

LEVEL: The works shall be within  $\pm 2\text{mm}$  of the specified level. The cumulative slope between the same locations on any panel shall not exceed 1 in 1000.

PLUMBNESS: The works shall be erected such that no point on any louvre panel is more than 3mm from its theoretical vertical/ diagonal plane. The cumulative slope between the same locations on any louvre panel shall not exceed 1 in 1000. The vertical plane shall be within  $\pm 2\text{mm}$  of the theoretical plane position.

A method statement detailing proposals to achieve the specified tolerances shall be submitted with the Tender. This shall demonstrate a clear understanding of the construction programme, the effects of the building structure and construction method and the fabrication method of the louvre panels.

Sufficient analysis of the erection sequence shall be undertaken to ensure that the installation tolerances stated above shall be met to the satisfaction of the Employer's Representative.

DIMENSIONAL CHECKING: Before work begins on Site the proposed method of dimensional setting-out and cross checking with adjacent trades and elements to satisfy the accuracy requirements shall be submitted to the Employer's Representative. The checking of any setting-out or of any line or level by the Employer's Representative, or his representative, shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

ALTERNATIVE TOLERANCES: Alternative tolerances to those specified may be permitted at the Employer's Representative's discretion, provided they are agreed in advance of manufacture of components.

The Working Drawings shall provide for sufficient tolerance in manufacture of the works in order to accommodate manufacturing tolerances of interfacing elements.

The tolerances stated herein shall be adhered to. No revisions to the tolerances to cater for inadequate control shall be permitted.

Use concealed anchorages where possible. Provide suitable washers fitted to screws (as recommended by the louvre manufacturer) where required to protect metal surfaces and to make a weathertight connection.

Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or non-metallic flashing.

Full details shall be submitted to the Employer's Representative for review of the proposed methods for achieving and constantly monitoring the fabrication tolerances during all stages of the work. Detailed records of the constant control and tolerances achieved shall be submitted to the Employer's Representative.

The works, when installed, shall not be subject to warping or twisting and shall be strictly rigid, firm, free from vibration, knocking, rattles, squeaks and other noises when subject to the worst combination of environmental conditions and wind loads.

All tolerances stated shall be measured and monitored at a mean temperature to be agreed with the Employer's Representative.

No rainwater ponding shall be permitted on any element of the works.

**3.2 ADJUSTING**

- A. Restore louvres damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Employer's Representative, remove damaged units and replace with new units.

### 3.3 LIGHTNING PROTECTION AND EARTH BONDING

Bonding to metal components shall be provided in accordance with EN 62305: Parts 1-4, to ensure continuity between adjacent sections, both vertically and horizontally over the whole façade. Bonding between sections shall have a minimum cross section of 50mm<sup>2</sup>. Any bolts used for bonding shall be of a minimum size of M10.

Bonding to structural steelwork shall be carried out at intervals at no greater than 10m horizontally and 20m vertically. The first level of bonding to the structural steelwork shall be at the highest floor level of each part of the building.

Provide studs/ bolts for subsequent connection.

All straps/ connections shall be concealed.

No straps shall be fixed along copings.

### 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal louvre panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal louvre panel installation, clean finished surfaces as recommended by metal louvre panel manufacturer. Maintain in a clean condition during construction.
- B. After metal louvre panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal louvre panels that have been damaged or have deteriorated beyond successful repair by finish touch up or similar minor repair procedures.

### 3.5 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s).
7. Warranties: Refer to Clause No's 1.15 & 1.17.
8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

### 3.6 WASTE MANAGEMENT

- A. As specified in Waste Management Plan and as follows. Separate waste products from contaminants. Do not include metal with wood, plastic, or any glass fibre, vinyl, decorative paper, or other finish. Place in designated area and protect from moisture and contamination.
- B. Identify manufacturer's policy for collection or return of remaining unused material and packaging material. Institute demolition and construction recycling to take advantage of manufacturer's programs. When such a service is not available, seek local recyclers to reclaim the materials.

**END OF SECTION 08 91 19**

**SECTION 11 13 00 – LOADING DOCK EQUIPMENT****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. To be read with the Contract, Drawings, BIM Manual and other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 SUMMARY**

- A. This specification details the Contractor's design, sourcing, fabrication, setting out, installation, inspection, testing, supervision, commissioning, co-ordination and warranting for loading dock equipment to include but not be limited to the following: dock bumpers, truck-trailer restraining devices, and industrial, mechanical and electro-hydraulic dock levellers of the fixed hinged type. The dock levellers (ramps) will span and compensate for space and height differentials between loading docks and freight carriers in order to facilitate safe and efficient freight transfer. The ramps are to be recessed into preformed pits in the loading docks. Test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation. To include all items necessary for full completion and finishing of the work not necessarily included.
- B. Related Sections:
1. Refer to the Structural Engineer's drawings and specifications for concrete work for recessed loading dock equipment and pit construction.
  2. Refer to the Electrical Engineer's drawings and specifications.
  3. Section 08 11 13 (Metal Doors and Frames).
  4. Section 22 30 00 (Foul Drainage) for pit drains for loading dock equipment permanently installed in pits.

**1.3 DEFINITIONS**

- A. Operating Range: Maximum amount of travel above and below the loading dock level.
- B. Working Range: Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

**1.4 COMPONENT OR ELEMENT TYPES**

EDR-010 – INSULATED LOADING DOCK SECTIONAL DOORS  
LDL-001 – LOADING DOCK LEVELLER  
LSL-001 – LOADING DOCK SCISSOR-TYPE DOCK LIFTS  
LDS-001 – LOADING DOCK DOOR SEAL  
SLS-001 – SCISSOR LIFT SYSTEM  
LDG-001 – LOADING DOCK WHEEL ALIGNMENT GUIDES  
LWL-001 – LOADING DOCK WHEEL LOCK

**1.5 REFERENCES:**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT  
Building Regulations 2010  
ANSI  
MH 30.1 ANSI Standard for the Safety, Performance and Testing of Dock Levellers Devices.  
IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS  
BRITISH STANDARDS INSTITUTION  
EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.  
EN 1991-1-1:2002 Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings. + AMD 15507, Corrigendum February 2010  
EN 1993-1-4:2006 Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels.  
EN 1999-1-1:2007 Eurocode 9: Design of aluminium structures. General structural rules. + AMD March 2010  
EN 10025-2:2004 Hot rolled products of structural steels. Technical delivery conditions for non-alloy structural steels.  
EN 10088-2:2005 Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.

EN 10088-3:2005 Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.

EN 10210-1:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

EN 10210-2:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties. + AMD 17062

EN 10219-1:2006 Cold formed welded structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

EN 12504-2:2012 Testing concrete in structures. Non-destructive testing - Determination of rebound number.

EN 12620:2013 Aggregates for concrete.

BS 6399-1:1996 Loading for buildings. Code of practice for dead and imposed loads. + AMD 13669

BS 7976-2:2002 Pendulum testers. Method of operation.

BS 8493:2008 Light reflectance value (LRV) of a surface. Method of test. + AMD March 2010

NA to EN 1991-1-1:2002:2005 UK National Annex to Eurocode 1: Actions on structures. General actions. Densities, self-weight, imposed loads for buildings.

NA to EN 1993-1-4:2006:2009 UK National Annex to Eurocode 3. Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting.

EN 1991-1-1 Eurocode 1: Actions on structures – Part 1-1: General Actions Densities, self-weight, imposed loads for buildings

EN 1570:1999 Lifting tables

EN 292-2:1991 Machine safety

EN 61000-6-2:2001 Electromagnetic compatibility. Generic standards. Immunity for industrial environments.

EN 61000-6-4:2001 Electromagnetic compatibility. Generic standards. Emission standard for industrial environments.

EN 60204-1:1997 Safety of machinery/Electrical equipment of machines/General requirements. INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO/CD 21542:2008 Building construction. Accessibility and usability of built environment. 2008 EU

Directive 2006/42/CE Machine safety

Directive 2004/108/CE Electromagnetic compatibility

Directive 2006/95/CE Low voltage

ISO INTERNATIONAL STANDARDS

International Standard ISO 14021–1999, Environmental labels and declarations—Self Declared Claims (Type II Environmental Labelling)

International Standard ISO 14025–2006, Environmental labels and declarations (Type III Environmental Declarations—Principles and Procedures)

International Standard ISO 14040–2006, Environmental management, Life cycle assessment principles, and frameworks

International Standard ISO 14044–2006, Environmental management, Life cycle assessment requirements, and guidelines

CEN Comité Européen de Normalisation (European Committee for Standardization) EN 15804—2012

Sustainability of construction works, Environmental product declarations, Core rules for the product category of construction products

International Standard ISO 21930–2007 Sustainability in building construction—Environmental declaration of building products

Federal Trade Commission, Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e)

Global Reporting Initiative (GRI) Sustainability Report

Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises

U.N. Global Compact, Communication of Progress

ISO 26000—2010 Guidance on Social Responsibility

ASTM Test Method D6866: [astm.org/Standards/D6866.htm](http://astm.org/Standards/D6866.htm)

International Standards ISO 14021–1999, Environmental Labels and Declarations—Self Declared

Environmental Claims (Type II Environmental Labelling)

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)

Guide Choosing construction products: Guide to the recycled content of mainstream construction products.

**1.6 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for loading dock equipment. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For loading dock equipment. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of dock seal and shelter fabric indicated.
- D. Samples for Verification: For each type of dock seal and shelter fabric indicated.

**1.7 INFORMATION SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Welding certificates.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency. Indicate compliance of dock levellers with industry and project requirements.
- D. Warranty: Sample of special warranty.

**1.8 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For loading dock equipment to include in operation and maintenance manuals.

**1.9 METHOD STATEMENTS**

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

**1.10 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Source Limitations: Obtain loading dock equipment and dock levellers from single source from single manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to applicable codes.
- D. Electrical Components, Devices, and Accessories: Tested by a qualified testing agency, and marked for intended location and application.
- E. Preinstallation Conference: Conduct conference at Project site.
  - 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
  - 2. Review sequence of operation for each type of loading dock equipment.
  - 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
  - 4. Review required testing, inspecting, and certifying procedures.

**1.11 DELIVERY, STORAGE, AND HANDLING**

- A. Store and handle dock seals and shelters in a manner to avoid significant or permanent damage to fabric or frame.
  - 1. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

**1.12 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual dimensions of construction contiguous with loading dock equipment, including recessed pit dimensions, slopes of driveways and heights of loading docks, by field measurements before fabrication.

**1.13 WARRANTY**

- A. Special Warranty for Dock Levellers: Manufacturer's standard form in which manufacturer agrees to repair or replace dock-leveller components that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:

- a. Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
  - b. Faulty operation of operators, control system, or hardware.
  - c. Deck plate failures including cracked plate or permanent deformation in excess of 6 mm between deck supports.
  - d. Hydraulic system failures including failure of hydraulic seals and cylinders.
2. Warranty Period for Structural Assembly: 10 years from date of Practical Completion.
  3. Warranty Period for Hydraulic System: 5 years from date of Practical Completion.
  4. Warranty shall be for unlimited usage of leveller for the specified rated capacity over the term of the warranty.

#### 1.14 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Practical Completion, provide 12 months' full maintenance by skilled employees of loading dock equipment Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper loading dock equipment operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

#### 1.15 DECLARATION OF CONFORMANCE

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE marking if they are to be placed on the market.

The performance requirements for the project.

The technical specifications standards described herein.

From July 2014 Structural steelwork and aluminium fell under the CPR and therefore requires DOPs and CE marking to be affixed to show compliance with EN 1090-1.

#### 1.16 SINGLE SOURCE WARRANTY

All components and "build-up of components" shall be covered by a single source, insurance backed warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified.

All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions.

Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Architect.

#### 1.17 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed with a maintenance free life in excess of 20 years. Within the period of "maintenance free life" the assembly shall perform at or above the levels specified elsewhere. In accordance with BS ISO 15686-5:2008 "Buildings and constructed assets. Service life planning. Life cycle costing".
- B. The term "Maintenance" shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.
- D. Component parts: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Architect must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.

- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.18 MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Validation according to the Eco-Management and Audit System (EMAS).
  - 3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.
- B. Loading Dock Equipment and associated systems as designed, supplied and installed by a manufacturer regularly engaged in the design and production of such systems.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Hörmann Ireland Ltd., Allied HUB, Whitemill Industrial Estate, Wexford Y35 XR22  
Tel: +353 (0)87 1652066. Email: s.doyle.wex@hoermann.ie. www.hoermann.ie

Ellickson Engineering, Kilmurry, Waterford, Co. Waterford  
Tel: +353 (0)51 831 500. Fax: +353 (0)51 390 263.

## SECTION 11 13 00

**PART 2 – PRODUCTS****EDR-010 – INSULATED ROLLER SHUTTER DOOR**

Electrically operated insulated roller shutter door to suit minimum clear ope sizes indicated on the drawings. Refer to plans, door elevations and Door Schedule.

Product reference: High Security Steel Roller Shutter.

Supplier: <https://www.ellickson.ie>

**PERFORMANCE:**

- Manufactured in accordance with BS EN 12489 and BS EN 12426.
- SR2 Insurance Roller Shutters Certified to LPS 1175 issue 7.
- Door to be fully weatherproofed, sealed and tested on site by the subcontractor prior to handover.
- External grade.
- Wind load: Class 5 to IS EN 12444. For design wind loads less than 1.00 kN /m<sup>2</sup>, less onerous classes will be permitted subject to approval by client.
- Water Penetration: Class 3 to IS EN 12445.
- Thermal insulation: min. 3.9 W/m<sup>2</sup>K to EN 12428, EN 13241-1.
- Speed: 200mm/sec.
- Thermal Performance : 1.5 W/m<sup>2</sup>K.
- CE marked to harmonized product standard BS EN 13241-1

**DOOR**

- Colour: Selected RAL colour as per elevation drawing to match adjacent cladding.
- Finish: Glavanised and powder coated.
- Material: Steel.
- Standard: BS EN 13241.
- Arrangement: Vertical.
- Profile: Curved.
- Dimension: 90mm.

**FRAME**

- Material: Steel.
- Finish: Glavanised and powder coated.

**SHUTTER BOX SPECIFICATION**

- Construction: 0.91mm bright spangle galvanised pressed steel coil casing available in various different designs to suit individual circumstances.

**OPERATION**

Mode: Automatic.

- Control: Standard security key switch or rocker switch.
- Battery Back up: Required.

**HARDWARE (All galvanised):**

- Drums, steel shaft, end bearing plates, intermediate bearing plates, bearings, steel coupler, plugs and winders for full assembly.

**LOCKING**

- Built in self-locking mechanism.
- No manual, automatic, or auxiliary locking system is required due to its patented self-locking technology.

**VERTICAL SIDE GUIDES**

- Manufacturer's standard.
- Size: 90 mm x 30 mm.
- Electric shutters require a 50 mm x 50 mm steel box section (both sides) used to allow for motor unit and safety brake.

**MOTOR**

- The door is arranged for an electric motor unit with manual hand hoisting and lowering facility. The motor unit is complete with an in-built safety drive system. Operating voltage 230v or 400v site dependant, complying with all current European safety standards.

**TRACKS:**

- Manufacturer's standard.
- All components galvanised and bolted together. No welding to break galvanised protection.
- Track splice plates.
- Side seals: EPDM.

**SAFETY:**

- Electrically operated doors come with manual override as standard.
- Cable safety brake device included on all doors.
- Spring Brake device standard on all doors.

## OTHER REQUIREMENTS:

- Door to be calibrated on site to ensure perfect balance.
- All non-statutory markings and labels to be removed.

LDL-001 – LOADING DOCK LEVELLER

N/A

LSL-001 – LOADING DOCK SCISSOR-TYPE DOCK LIFTS

N/A

LDS-001 – LOADING DOCK DOOR SEAL

N/A

SLS-001 – SCISSOR LIFT SYSTEM

Product reference: Vertical Platform Scissors Lift.

Supplier: <https://www.ellickson.ie>

- Capacity; 5,000 kg
- Platform size;
- Width : 2000mm
- Length : 3000mm
- Stroke; 1600mm
- Finish; Galvanised and polyester powder coated RAL 7016.
- Tear plate surface 6/8 (sqm).
- Flip up access ramp 1.1m long with railing and gates.
- Bolted handrail for SLT to deck of Scissor Lift Platform in H1100mm to both long sides.
- 4 x sided chain mesh protection.
- Double interlocked pedestrian gate to both short sides.
- Button panel 2 buttons up-down + mushroom head.
- Deck elevation movement by hydraulic cylinders.
- 24V security electro valve.
- Security valve in hydraulic cylinders in the event of hydraulic hose failure.
- Perimeter toe guard protection with movement by dead-man button.
- 230/400 volt 3 phase motor.
- Working temperature range (-10C to 40C).
- Noise level <70db.
- Max speed for traffic over deck 10km/h.
- Maximum number of recommended work cycles per hour; 8 per hour.
- Accessories: Electronic interlocked manual boom gates, fixed railings, hydraulic load lip, button panel. Provide eye bolt on exterior wall to secure chock to.
- Installation: Surface mounted onto concrete slab. Fixing detail to be submitted to Structural Engineer for approval.
- Compliance: European UNE-EN 1570 and EN1570-1 standards.

LDG-001 – LOADING DOCK WHEEL ALIGNMENT GUIDES

N/A

LWL-001 – LOADING DOCK WHEEL LOCK

N/A

## SECTION 11 13 00

**PART 3 – EXECUTION**

## 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.
- B. Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.
- C. Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
- B. Set curb angles in concrete edges of dock-leveller recessed pits with tops flush with loading platform. Fit exposed connections together to form hairline joints.
- C. Set curb angles in concrete edges of truck-leveller recessed pits with tops flush with driveway. Fit exposed connections together to form hairline joints.
- D. Place self-forming pan system for [recessed dock] [edge-of-dock] levellers in proper relation to loading platform before pouring concrete.
- E. Clean recessed pits of debris.

## 3.3 INSTALLATION

- A. General: Install loading dock equipment, including motors, pumps, control stations, wiring, safety devices, light-communication systems and accessories as required for a complete installation.
  - 1. Rough-in electrical connections.
- B. Recessed Dock Levellers: Attach dock levellers securely to loading dock platform, flush with adjacent loading dock surfaces and square to recessed pit.
- C. Edge / Top-of-Dock Levellers: Attach dock levellers to loading dock platform in a manner that complies with requirements indicated for arrangement and position relative to top of platform.
  - 1. Weld anchor holes in contact with continuous embedded loading dock edge channel. Weld or bolt bumper blocks to face of loading dock.
- D. Truck Levellers: Attach truck levellers securely to driveway construction with expansion anchors and bolts.
- E. Truck Restraints: Attach truck restraints in a manner that complies with requirements for arrangement and height required for device to engage vehicle rear-impact guard. Interconnect control panel and signals with dock leveller.
  - 1. Wall-Mounted Units: Weld truck restraints to steel curb angle, edge channel, mounting plate embedded in loading dock edge.
  - 2. Wall-Mounted Units: Anchor truck restraints to face of loading dock with expansion anchors and bolts.
  - 3. Driveway-Mounted Units: Anchor truck restraints to driveway with expansion anchors and bolts.
  - 4. Pit-Mounted Units: Anchor truck restraints to concrete pit with expansion anchors and bolts.
- F. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.
  - 1. Welded Attachment: Plug-weld anchor holes in contact with steel inserts and fillet weld at other locations.
  - 2. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.
  - 3. Screw Attachment: Attach dock bumpers to wood construction with lag bolts as indicated.
- G. Dock Lifts: Attach dock lifts securely to [loading platform] [floor of recessed pit] [surface of driveway].
- H. Dock Seals: Attach dock-seal support frames securely to building structure in proper relation to openings, dock bumpers, and dock levellers to ensure compression of dock seals when trucks are positioned against dock bumpers.

- I. Dock Shelters: Attach dock shelters securely to building structure in proper relation to openings, dock bumpers, and dock levellers to ensure an effective seal of dock-shelter curtains with sides and top of truck body when trucks are positioned against dock bumpers.
- J. Transparent-Strip Door Curtains: Attach door-curtain mounting system to lintel with screw anchors or toggle bolts. Mount curtain strips to achieve overlap indicated.

### 3.4 ADJUSTING

- A. Adjust loading dock equipment to function smoothly and safely, and lubricate as recommended by manufacturer.
- B. Test dock levellers and lifts for vertical travel within operating range indicated.
- C. After completing installation of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as components are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation(s), clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace elements and or components that have been damaged or have deteriorated beyond successful repair by finish touch up or similar minor repair procedures.

### 3.7 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

- 1. Set of "As Built" drawings and material certification.
- 2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the damp proofing and radon protection installation, including all accessories.
- 3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
- 4. Product Technical Data Sheets.
- 5. Installation Method Statement(s) and any agreed revisions.
- 6. Certified copies of each report prepared by the manufacturer's representative(s) (as noted previously).
- 7. Warranties: Refer to Clause No's 1.13 & 1.16
- 8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
- 9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE mark.

**END OF SECTION 11 13 00**

**SECTION 22 14 00 – RAINWATER DRAINAGE****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. To be read with the Contract, Drawings, other related sections of the Specification, Preliminaries and General and Supplementary Contract Conditions.

**1.2 DESCRIPTION**

- A. This section describes the requirements for a complete Contractor designed, Rainwater Drainage design solution in which the rainwater drainage system manufacturer is able to provide full, computer aided design calculations based on current rainfall data from the Meteorological Service of Ireland, including all piping, outlets, leak detection and all necessary accessories for full completion and finishing of the work.
- B. The Contractor shall design, test, source, supply, fabricate, set out, install, inspect, supervise, commission, co-ordinate and warrant the complete construction as described in this section, in accordance with the schedules and drawings, the preliminaries and general conditions attached to the tender documentation. To include all items necessary for full completion and finishing of the work not necessarily included.

**1.3 RELATED WORK**

Section 07 21 00 – Thermal Insulation  
Section 07 50 00 – Membrane Roofing  
Section 07 84 00 – Firestopping  
Pipe Hangers and Supports, Materials Identification.  
Pipe Insulation.

**1.3.1 COMPONENTS / ELEMENTS**

SWD-001 – VISIBLE RAINWATER PIPEWORK  
SWD-002 – CONCEALED RAINWATER PIPEWORK  
SWD-003 – INSULATION TO INTERNAL PIPELINES  
SWD-004 – RAINWATER OUTLETS  
SWD-005 – FLOW SWITCH CONTROL LEAK DETECTION/SENSOR  
SWD-006 – DOORWAY DRAINAGE CHANNEL  
SWD-007 – CLEANOUTS  
SWD-008 – WATERPROOFING THROUGH FLOORS

**1.3.2 DEFINITIONS**

Where the word 'Design' occurs in this document it will be described as 'Design\*'. The Asterisk implies that 'Under the design portion requirements of this specification the Contractor is requested to take the design intent and apply their own manufacturers systems and materials performance data to comply with all criteria set out in this specification document and the design intent drawings'.

**1.4 SECTION INCLUDES**

- A. The rainwater drainage system for the project includes for rainwater drainage from roofs and canopy. All rainwater to drain to the main public surface water drain.
1. This section includes for the Contractor's design for the rainwater drainage system for the building to include but not be limited to the following: the provision of full, computer aided design calculations, rainwater pipework and all associated components internally and externally.
  2. To include but not be limited to; pipe bends, branches, access pipes, sockets, offsets, shoes, fixing clips, wall fixings, access covers, anti-leaf grilles and covers, acoustic insulation to pipework, leak detection system to rainwater outlets and all or any other components necessary to provide a secure water tight, rainwater drainage system and achieve the layout and performances designed by the Contractor based on the requirements of the applicable National Annexe of EN 12056: Part 3 and current rainfall data from the UK Meteorological Service not necessarily indicated on the Drawings and documents. The rainwater drainage calculations are to incorporate changing rainfall patterns and make provision for extreme weather occurrences.  
To include but not be limited to the following:
- B. Gravity rainwater drainage system.
1. Rainwater Outlets: To all Building(s).
  2. Internal and External Pipework: HPDE fully welded and sealed rain water down pipe systems.

Where possible all rainwater pipework is to be concealed, however where this is not achievable, exposed drainage pipework to have polyester-powder coated prefinished aluminium cladding / covers concealing all pipe insulation. Cladding to be crimped at bends and discreet fixings located to the top of pipework (non-visible).

RAL reference: TBC.

3. Ancillary assemblies – adaptors, rodding access etc. Connector / Adaptor Pieces required providing internal double seals between outlet and downpipe pipework. Fixing plates, brackets, clips, angles and attachments to be included.
4. Insulation to all concealed rainwater pipe work.
5. Fixing plates, masking plates, brackets, clips, angles to be included and attachments.
6. Flashings, seals and sealants.
7. Interface with roofing, cladding and underground drainage systems.
8. Drilling of structural steel and concrete (if required, approval to be given from the Employer's Representative, and Contractor).
9. Finishes to any exposed external and internal surfaces.
10. Mock-ups (to be approved prior to final installation).
11. Samples (to be approved prior to any installation been started with regard to each and individual item).
12. All Testing.
13. Builders work in connection with the whole rainwater disposal system.
14. Detailed working drawings (to be approved by the Contractor and Employer's Representative).
15. All items not necessarily shown on the drawings required for the proper completion of the subcontract works and to comply fully with this performance specification.
16. Professional Indemnity Insurance for design of all rainwater disposal systems and components thereof.
17. All elements to achieve Firestopping requirements in accordance with the requirements of the fire safety certificate.
18. Certification of FM Global standards
19. Overflow switches and Leak Detection system to be co-ordinated with (as part of the mechanical and electrical works).
20. Finishes proposals to exposed external and internal surfaces.
21. Samples (to be approved by the Employer's Representative prior to the commencement of each installation and with regard to every individual item).
22. All components to be CE Marked.
23. All 'Builders work' in connection with the rainwater outlet and pipework installation.
24. Detailed schematic drawings designed and prepared by the Contractor (to be approved by the Employer's Representative).
25. Rainwater calculations (based on the roofing extent) from the Contractor proposed indicating that the rainwater system to be installed shall be capable of discharging flow capacities as indicated in this document.
26. All items not necessarily shown on the drawings required for the full and accurate, watertight completion of the works and to comply fully with this specification.
27. The Contractor shall be entirely responsible for the design and installation of the rainwater disposal system and for the completed installation, achieving or exceeding the design and performance criteria for all components and assemblies of the installation.
28. The Contractor shall be responsible for the final lining and levelling of the rainwater disposal system.
29. Where and to the extent that materials, products and workmanship are not fully specified, they shall be suitable for the purposes of the works stated in or reasonably to be inferred from the contract documents, and are to be the best of their respective kinds and all articles and materials are to be not less than those outlined in this performance specification.

#### 1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

DEPARTMENT OF HOUSING, PLANNING AND LOCAL GOVERNMENT

Building Regulations 2010

BRE

Green Guide to Specification [www.bre.co.uk/greenguide](http://www.bre.co.uk/greenguide)

Good Repair Guide 9 Repairing and replacing rainwater goods. 1997

Information Paper 8/01 Weathering of plastics pipes and fittings. 2001

IRISH (IS) / EUROPEAN (EN) / BRITISH (BS) STANDARDS

BRITISH STANDARDS INSTITUTION

EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.

EN 681-1:1996 Elastomeric seals. Materials requirements for pipe joint seals used in water and drainage applications. Vulcanized rubber. + AMD 10214, AMD13706, AMD14178, AMD 15832

EN 877:1999 Cast iron pipes and fittings, their joints and accessories for the evacuation of water from building. Requirements, test methods and quality assurance. + A1:2006, Corrigendum January 2008

EN 1329-1:2000 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Unplasticized poly (vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system.

EN 1462:2004 Brackets for eaves gutters. Requirements and testing.

EN 1519-1:2000 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Polyethylene (PE). Specifications for pipes, fittings and the system. + AMD 13817

EN 10226-1:2004 Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Dimensions, tolerances and designation.

EN 10255:2004 Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions. + AMD 17127, AMD 17157

EN 10346:2009 Continuously hot-dip coated steel flat products. Technical delivery conditions.

EN 12056-1:2000 Gravity drainage systems inside buildings. General and performance requirements.

EN 12056-2:2000 Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation.

EN 12056-3:2000 Gravity drainage systems inside buildings. Roof drainage, layout and calculation. + AMD 17041

EN 12056-5:2000 Gravity drainage systems inside buildings. Installation and testing, instructions for operation, maintenance and use.

EN 12200-1:2000 Plastics rainwater piping systems for above ground external use. Unplasticized poly (vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system.

EN 13501-1:2007 Fire classification of construction products and building elements. Classification using data from reaction to fire tests. + AMD November 2009

BS 416-1:1990 Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron. Specification for spigot and socket systems.

BS 460:2002 Cast iron rainwater goods. Specification. + AMD 15095, AMD 16890, AMD 17425, AMD November 2009

BS 476-7:1997 Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products.

BS 1449-1-1:1991 Steel plate, sheet and strip. Carbon and carbon-manganese plate, sheet and strip. General specification.

BS 1710:1984 Specification for identification of pipelines and services. + AMD 6012

BS 3868:1995 Specification for prefabricated drainage stack units in galvanized steel.

BS 4514:2001 Unplasticized PVC soil and ventilating pipes of 82.4 mm minimum mean outside diameter, and fittings and accessories of 82.4 mm and of other sizes. Specification.

INTERNATIONAL CODE COUNCIL (ICC):

IPC-06 International Plumbing Code

WASTE AND RESOURCES ACTION PROGRAMME (WRAP)

Guide Choosing construction products: Guide to the recycled content of mainstream construction products. Version 4. 2008

## 1.6 SUBMITTALS

- A. MANUFACTURER'S TECHNICAL PRODUCT DATA: For each type of product.
- B. Manufacturer's Literature and Data:
  - 1. Piping.
  - 2. Roof Drains & Sumps.
  - 3. Cleanouts.
  - 4. All items listed in Part 2 - Products.
  - 5. Vapour barrier within pipework ducts.
  - 6. Acoustic insulation within pipework ducts.
  - 7. Fire resistant collars / devices, co-ordinate with section 07 84 00 (Firestopping).
- C. SHOP DRAWINGS: are to include but not be limited to the following:
  - Plans, schematics, and diagrams indicating the general location and arrangement of piping systems. Indicated locations and arrangements used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations are to be clearly set out. Detailed shop drawings of clamping device and extensions when required in connection with the waterproofing membrane to the roof area are to be incorporated.

Calculations for the provision of Rainwater outlets and pipework in accordance with the requirements of the applicable National Annex of EN 12056: Part 3 and current rainfall data from the UK Meteorological Service.

- D. The following details or samples are required at the time of tender:
1. Proposed outlet details including roofing and cladding systems interface.
  2. Proposed hopper and fixing details.
  3. Proposed pipework detail including interface with cladding system and fixing to support steel.
  4. Proposed ground level details integrated with proposed below ground drainage system.
  5. Compliance with EN 12056-3:2000 'Gravity drainage systems inside buildings. Roof drainage, layout and calculation'.
  6. Design, fabrication, supply and installation programme to be co-ordinated with Contractors programme.
  7. Test certificates demonstrating compliance to the tests described below.
  8. Test certificates to demonstrate compliance with local code in terms of fire rating of the materials and proposed assemblies.
- E. WEIGHT & LOADINGS:  
Full information in respect of the following shall be supplied prior to commencement of fabrication:  
Weight of rainwater disposal system and assemblies on or attached to the building.  
Description of distribution of rainwater system load to building.
- F. LABORATORY TEST REPORTS: For solvent cements and adhesive primers, documentation indicating that:  
All products should be tested against EN 13999-1: 2007. Carcinogenic or sensitizing volatile substances should be absent when tested to EN 13999-2:2007 – VOCs, EN 13999-3:2007 – Volatile Aldehydes and EN 13999-4:2007 – Volatile Diisocyanates.
1. The contractor is to include as part of the tender process, written evidence from product manufactures confirming that Carcinogenic or sensitizing volatile substances are not present when tested to EN 13999-2:2007 – VOCs , EN 13999-3:2007 – Volatile Aldehydes and EN 13999-4:2007 – Volatile Diisocyanates.

#### 1.7 INFORMATION SUBMITTALS

- A. Product Test Reports: For each type of rainwater junction and joint assembly, for tests performed by an independent qualified testing agency.
- B. Construction Certification: For assemblies required to be fire-rated and including labelled assemblies.
- C. Acoustic laboratory test certificates demonstrating compliance with acoustic performance requirements for pipework ducts.
- D. Field quality-control reports.
- E. Documentation of manufacturer's take-back programme for damaged products, packaging etc. Include the following:
1. Appropriate contact information.
  2. Overview of procedures.
  3. Identify manufacturer's policy for collection or return of remaining unused material and packaging material.
  4. Indicate manufacturer's commitment to recycle and/or reuse reclaimed materials and packaging.
  5. Limitations and conditions, if any, applicable to the project.
- F. Provision of Mock-Ups;  
Provide for 1no. full size mock-up, including interface with roofing and cladding systems, of each of the following:
- Rainwater outlets.
  - Sumps.
  - Hoppers.
  - Pipework.
  - Adaptors.
  - Rodding Access.
  - Fixing plates, masking plates, brackets etc.
  - Pipework jointing detail.
  - Insulated pipework detail.
  - Roof penetration details.
- The Mock-Ups to be installed on the construction site. Subsequent to Employer's Representative's approval of each of the Mock-Ups, they are to remain undisturbed as 'Benchmark' Controls.

## 1.8 METHOD STATEMENTS

The Contractor shall provide detailed method statements describing the sequence and methods to be employed in carrying out the works identifying proposed solutions and processes with regard to health and safety, workmanship, fabrication, fixing, securing, storing and handling, setting out, site assembly and protection.

## 1.9 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with EN 1329-1:2014 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Unplasticised poly (vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system for plastic piping components.

## 1.10 PERFORMANCE REQUIREMENTS

- A. Complete the design of the rainwater drainage system to EN 12056-3, clauses 3-7, National Annexes and current rainfall data from the UK Meteorological Service.
- B. Rainwater goods to be constructed in accordance with BS 460, EN 877, BS 437 and EN 1462 and /or ASTM NSF Standards, whichever are the more onerous.
- C. The system shall be designed in accordance with the applicable National Annexe of EN 12056: Part 3 and rainfall data from the UK Meteorological Service.
- D. The system shall be designed and fabricated to provide a suitable free-draining, gravity rainwater management system comprising of rainwater outlets, pipes, joints and associated main high level drainage pipes necessary to provide a composite gravity rainwater drainage system.
- E. The system shall be based on a composite design solution in which the system manufacturer is able to provide full, computer aided design calculations based on current rainfall data from the Meteorological Service of Ireland.
- F. Other requirements: Fit pre-formed 25mm thick insulation pipe wraps to prevent transmission of audible noise from the gravity roof drainage system and all internal pipework.
- G. All pipework travelling through heated spaces shall be insulated to prevent condensation.
- H. Gravity outlets shall be available in various materials to suit roof build-up(s) as indicated on the Drawings.
- I. Refer to the Mechanical and Electrical Service, and Fire and Acoustic Consultant's drawings and specifications for the project.

## 1.11 DECLARATION OF CONFORMANCE

The Contractor must comply with the following requirements. Records are to be kept and provided for inspection of the following:

- Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry CE Marking if they are to be placed on the market.
- The performance requirements for the project.
- The technical specifications standards described herein.

## 1.12 SINGLE SOURCE WARRANTY

- A. The Contractor shall submit to the Employer (under the terms of the Contract) an insurance backed warranty guaranteeing the design and performance of his products and workmanship for a period of twenty years from the date of Practical Completion.
- B. All components and 'build-up of components' shall be covered by a single source, insurance backed warranty, fully guaranteed by the supplier / manufacturer. Proprietary systems shall be Agrément tested and certified.  
A 20 year product, design, workmanship, consequential damages and pure financial loss Warranty is to be provided upon completion following a Final Inspection and 'Sign Off' by the Rainwater Contractor, Contractor, Employer's Representative and Client's Representative.
- C. All products incorporated in the works to be in accordance with the manufacturer's current technical data sheet and applied in accordance with the manufacturer's instructions. Prior to ordering, samples shall be submitted of all materials to be used, together with current technical data sheets and copies of relevant test certificates.
- D. Where materials overlap or are used in conjunction with other products, they shall be demonstrated by the Contractor to be compatible prior to full and final installation / application, to the approval of the Employer's Representative.

## 1.13 MANUFACTURER'S PROVISION OF ON SITE TRAINING

The manufacturer(s) is to provide 'toolbox talks' on site, on appropriate installation and fixing requirements for all drainage products to be installed.

The Contractor shall demonstrate that the manufacturer(s) has visited site and provided Instruction on correct installation for each type specified.

Inspections: Manufacturer(s) to inspect installation of each drainage installation type (frequency of such site visits to be agreed with the Employer's Representative and the Employer's Representative) to ensure appropriate and correct installation(s) and complete an inspection report for each visit.

Verification: The Manufacturer(s) to verify correct installation of each inspected drainage installation type.

Warranty: Manufacturer(s) to provide Project Specific Performance Warranty upon completion of the installation of the drainage installation types.

The Employer's Representative will not accept installations / applications of drainage installation(s) which have not been approved by the pertinent manufacturer(s).

#### 1.14 TESTING REQUIREMENTS

The Contractor shall include for testing by an accredited independent testing specialist or provide independently certified test data to demonstrate compliance with the Specification.

The provision of testing data or the carrying-out of tests does not relieve the Contractor of his responsibilities regarding the performance requirements, durability or service life requirements, etc.

#### 1.15 LIFE EXPECTANCY, MAINTENANCE AND REPAIR

- A. The whole and each element of the installation(s) and construction shall be designed with a maintenance free life in excess of 20 years. Within the period of 'maintenance free life' the assembly shall perform at or above the levels specified elsewhere. In accordance with BS ISO 15686-5:2008 'Buildings and constructed assets. Service life planning. Life cycle costing'.
- B. The term 'Maintenance' shall be deemed to exclude cleaning and lubrication.
- C. The Contractor will be required to provide the manufacturer's instructions on maintenance and give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.
- D. COMPONENT PARTS: The Contractor will be required to state the period of maintenance free life of any component part of the assembly, where this differs from the period of maintenance free life of the whole assembly. Where not stated, it is assumed to be the life of the whole assembly.
- E. Guarantees are requested prior to nomination of all component parts stating their maintenance free life, their guaranteed life and their life expectancy.
- F. The Employer's Representative must be informed in writing of any aspect of the construction which may not meet this requirement, and his specific approval granted for any relaxation.
- G. Structural fixings, frames, or supported components shall be designed to remain in position and to meet structural stresses and loadings for a period in excess of 50 years without maintenance or inspection.
- H. Elements of the assemblies shall be capable of repair or replacement without the minimum removal of adjacent works.

#### 1.16 INDICATIVE MANUFACTURERS

- A. The Manufacturer should be registered to ISO 9001 and have or provide the following:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Validation according to the Eco-Management and Audit System (EMAS).
  - 3. Construction waste take back programme for the purpose of reducing jobsite waste by taking back their uninstalled waste packaging and system waste.

TTC Timmler Technology GmbH, Christian-Schäfer-Str.8, D-53881 Flamersheim, Germany  
Tel +49 (0)2255 921 0. Fax +49 (0)2255 921 500. info@ttc-technology.eu. www.ttc-technology.eu

Harmer, Alumasc, Station Road, Burton Latimer, Kettering, Northamptonshire, NN15 5JP. UK  
Tel: +44 (0)1536 383810. Fax +44 (0)1744 648401. www.alumascrainwater.co.uk

Wavin Ireland, Dublin Road, Balbriggan, Co Dublin  
Tel: +353 (0)1 802 0200. wavin.com

ACO Technologies, ACO Business Park, Hitchin Road, Shefford, Bedfordshire, SG17 5TE, UK  
Tel: +44 (0)1462 816666. Fax: +44 (0)1462 815895. www.aco.co.uk



SECTION 22 14 00

**PART 2 – PRODUCTS**

SWD-001 – VISIBLE RAINWATER PIPEWORK

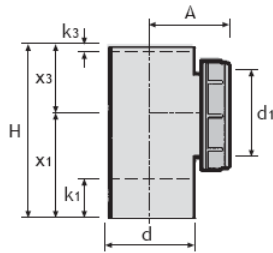
- A. Round aluminium down pipe 150mm, 2mm min. thickness (serving hoppers, discharging to BIGTs at ground level).  
 Product reference: Alumasc Flushjoint Aluminium.  
 Extruded aluminium in material 6063, T6 to BS1474:1972.  
 To be polyester powder coating is in accordance with BS 6496:1984. RAL colour to match adjacent cladding and to Employer’s Representatives approval.  
 Fire Rating: Non-combustible to BS 476, Part 4: 1970 (1984). Melting temperature for aluminium is approximately 660°C.
- B. Hopper heads: square profile 3mm polyester powder coating aluminium to match downpipes.

SWD-002 – CONCEALED RAINWATER PIPEWORK

Concealed Type: High density polyethylene (HDPE) complete with pipes, fittings and accessories supplied in accordance with Contractors details. System to be welded and sealed throughout.

Nominal size(s): 160mm diameter in accordance with the following:  
 Standard: To EN 1519-1 or Agrément certified.  
 Manufacturer: Geberit HDPE to the Employer’s Representative’s approval via samples.  
 Product reference: Proprietary plumbing & drainage HDPE rainwater system. Internal rainwater pipes shall be capable of withstanding a constant air pressure of 38mm water gauge for a period of 3 minutes.  
 Recycled content: 20% (minimum) to EN ISO 14021. Nominal size: DN160. Brackets: Galvanized steel brackets. Fixings: Resin anchor bolts. Size: M10.  
 Jointing: Solvent welded in accordance with manufacturer's recommendations.  
 Accessories: Insulation and Intumescent collars. Branches, bends and rodding eyes.  
 Rainwater pipework in all locations shall be insulated.  
 Flow Rates: Calculate flow rates in accordance with the current BS Standards and Codes of Practice i.e. at 66% free capacity.  
 Typically a 160mm rainwater pipe shall have a minim flow rate of 13.5l/s.  
 Method of jointing: The entire rainwater pipe system shall be fully sealed.  
 Butt fusion weld by machine as per manufacturer recommendations to form a fully homogenous single length pipe. Pipework shall form one continuous piece from rainwater outlet to discharge point into the manhole external to the structural frame.  
 Support with proprietary adjustable galvanised steel brackets / hangers (suitably sleeved as per manufacturer recommendations to allow for movement / expansion) at 900mm vertically plugged and screwed to structure.  
 Provide independent support rails where necessary to ensure pipework is always supported as per the manufacturer recommendations.  
 Horizontal runs to falls shall be supported by proprietary adjustable galvanised steel brackets plugged and screwed to concrete or structural steelwork soffit at max. 500mm centres with stainless steel screws holding pipes 150mm min clear of soffit.  
 The contractor is to ensure that adequate service void is provided for the pipes and to advise the Employer’s Representative in good time if alternative routes are required.  
 Provide independent support rails where necessary to ensure pipework is always supported as per the manufacturer recommendations.  
 Provide all necessary swan necks, bends and components to ensure that the system is complete and co-ordinated through the building.  
 The fully installed and sealed insulated system shall include all pipework, bends, long radius bends, sweep tees, caps, black caps, rodding eyes and connections to roof outlets.  
 Side entry rodding eyes shall be provided to every rain water downpipe at ground floor level, prior to exiting the building, as per the following:

Product Code	Dia (mm)	H (mm)	d1 (mm)	A (mm)	x1 (mm)	x3 (mm)	k1 (mm)	k3 (mm)
110 dia pipe	110	225	110	105	135	90	40	15.6
160 dia pipe	160	350	110	130	210	140	115	45



Generally the rain water pipe work system has been designed so that all pipe runs are routed vertically from the highest point of entry into the building to their final destination at ground floor. The lowest level of the pipework will be either via accessible shafts or dedicated accessible column boxings.

Access panels to be located in each rainwater downpipe location. Refer to item below.

The Contractor undertaking the detailed design development of this system shall comply with this design principle.

Minimum clear 600 x 600mm access panels – Located in Ground Floor Plasterboard risers and or stacks, 1000mm above finished floor finish where rainwater down pipes are located.

Reason: Access panels are required for maintenance, cleaning and access to rodding eye locations.

Rainwater Coupling / Socket Interface: Type: High density polyethylene (HDPE) coupling piece is required for the interface between rainwater outlet and rainwater pipework. Coupling to be extended EPDM cord ring type.

Nominal size(s): 110 / 160mm diameter depending on rainwater pipework.

Product Reference:

1. Geberit HDPE Socket, product code: 369.930.16.1 (160diameter interface).
2. Geberit HDPE Socket, product code: 367.930.16.1 (110diameter interface).

#### SWD-003 – INSULATION TO INTERNAL PIPELINES

Fit pre-formed 25 mm thick insulation pipe wraps to prevent transmission of audible noise from the gravity roof drainage system and all internal pipework

Material: Preformed flexible closed cell split tube. Thermal conductivity (maximum): 0.045 W/mK.

Fire performance: In accordance with the requirements of Class 0 spread of flame when tested to BS 476: Part 7 or Class C to EN 13501, whichever is the more onerous (with the most onerous taking priority).

#### SWD-004 – RAINWATER OUTLETS

Refer also to Specification Sections in Division 07 for Rainwater Outlet details.

RWO scupper outlets to be manufactured as per Architects details. All RWO calculations to be confirmed by SOPREMA Ireland as in compliance with FM design guidelines to suit local statistical rainwater data for 100 storm event.

Rainwater Outlets: Horizontal flat roof types complete with proprietary threaded connection to spigot, sized in accordance with project specific rainwater design calculations to EN 12056. Sized and supplied by waterproofing system manufacturer and incorporated in total roof system warranty.

Indicative Reference: Soprema scupper detail ranges.

The rainwater outlet is to be attached to an insulated spigot to avoid thermal bridging where the spigot perforates the roof construction.

Description: 150mm nominal capacity (internal diameter) aluminium rainwater outlets cast in LM6 aluminium silicon alloy to BS 1490: 1988.

Flow Rates: Calculate flow rates in accordance with the codes of practice i.e. at 66% free capacity.

Typically a 150mm downpipe with an anti-vortex roof outlet yields a flow rate of 13.51l/s.

Wall thickness: minimum 5mm resulting overall diameter of 110 to 160mm.

Accessories: Domed cover grate to top.rain

Outlet configuration: Supply outlets for vertical, horizontal or 45 degree discharge as required for connection / co-ordination with the drainage paths, Flow rate performance shall be unaffected.

The proposed rainwater outlet shall incorporate a baffle within the grating, to prevent water swirl and air entrapment, enabling the outlet to drain at 90% of its pipe capacity i.e. anti-vortex performance is required.

All rainwater outlets shall be fully compatible to the roofing system specified and shall be as per the roofing manufacturer's recommendations.

All rainwater outlets and rainwater pipe assemblies (and their related components) shall be considered as singular systems and certification / warranties shall be required to this system as a singular entity.

Connection to RWP: The rainwater outlet shall be supplied complete with couplers to enable the rainwater pipe system being fully sealed to maintain the pressure integrity of the entire system. Each joint shall be pressure tested on completion of installation to verify proper installation.

Support: All rainwater outlets and connections to the rain water pipe systems shall be adequately supported as per the manufacturer / specialist contractor requirements to accommodate dead / live / dynamic loads (fluid movement). This shall include any support / bracketing / trimming requirements.

Upon completion of a roofing contract and prior to handover, all outlets should be inspected for missing fixings and the correct fitting of clamps and gratings. Missing studs, nuts or bolts must be ordered and fitted in order to ensure proper function of the rainwater outlet.

#### SWD-005 – FLOW SWITCH CONTROL LEAK DETECTION / SENSOR

A flow switch shall be fitted to the overflow to connect to the BMS.

Contractor to allow for the supply installation testing and commissioning of a gully overflow and water detection system for each of the roof areas. The system to be supplied under the BMS Specialist Scope of Work.

Water Detection panel/s type WD-AMX-1 modules (24volt ac version) Spot Detectors type WWD-PS point sensor and be suitable for vertical mounting if required.

All Water Detection Sensors / panels to be installed within the MCC / BMS panels within associated or local plantroom with an illuminated indicator for each sensor and an audible alarm on the activation of any sensor. Alarm mute facility should also be available at the panel. Alarm mute should not be indefinite. The alarm unit should also provide a common alarm output to the BMS. The water detection system to be supplied and commissioned as part of the BMS installation including all interfaces, Graphics etc. All associated wiring to be carried out by the electrical contractor with final terminations by the BMS specialists contractor. Cables to be 4 core beldon to each detector.

A laminated wall chart to be provided for leak detector locations.

Reference Product: Sontay Point Water Sensor and Water Detection Controller.

#### SWD-006 – DOORWAY DRAINAGE CHANNEL

Proprietary door way drainage system to remove surface water from doorways allowing a standard level threshold to overlap its upper surface to give protection against wind-driven rain as indicated on the Drawings.

Indicative product: Aco Door Way Drain or acceptable equivalent.

Description: Polypropylene threshold drainage channel with stainless steel grating fixed flush to finished surface.

The channels shall have a nominal size 100mm bore.

The type of fall shall be constant invert.

Accessories shall include 110 mm vertical outlet, connection piece, end caps and gully unit with mud bucket. Refer to Civil Engineer's specification and detail.

Joints shall be sealed in accordance with manufacturer's recommendations

Cover grating shall be a two piece stainless steel grating with small 10mm slots drain.

Fixings shall be push-fit.

Loading grade shall be Load Class A15 to EN 1433.

Haunching: Concrete bed and haunch shall have a minimum compressive strength of 25N/ mm<sup>2</sup> as indicated on the Employer's Representative's Details.

Access: Part M compliant level threshold drainage.

#### SWD-007 – CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm not less than 100 mm for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm shall be provided for clearing a clogged rainwater line.
- B. Floor cleanouts shall be grey iron housing with clamping device and round, secured, scoriated, grey iron cover conforming to ASME A112.36.2M. A grey iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm. When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts.

Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors and porcelain tile floors shall be provided with square top covers recessed for tile insertion.

Where appropriate, the raised access floor cleanout markers shall be provided in the floor void. Two way cleanouts shall be provided where indicated on the drawings and at each building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty.

- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150mm by 150mm shall be provided at each wall cleanout.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

#### SWD-008 – WATERPROOFING TROUGH FLOORS

See detail shown on drawings.

- A. Provide sleeve flashing at points where pipes pass through each membrane waterproofed floors or walls and each floor level slab. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor (and or) membrane.
- B. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 150 mm above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked and fire proofed joint shall be provided at the top hub.

#### 2.1 RAINWATER DRAINAGE STRATEGY

Rain water drainage from Roof(s) is generally external through two-way type outlets through parapets connecting to external hopper heads and downpipes. Outlets to be provided complete with metal clamping ring and grates.

Downpipes routed vertically and connected to surface water drainage system / rainwater harvesting system. Refer to Civil Engineer's specification and detail.

Drainage from roof of overhangs, canopies etc., to be connected to surface water drainage system.

All external rainwater pipework to be PPC aluminium.

All rainwater pipework routed internally to be HDPE fitted with 25mm thick rigid pipe insulation.

All rainwater and drainage outlets to be fitted with a Leak Detection System.

#### 2.2 RAINWATER DRAINAGE BELOW SLAB

Refer to Civil Engineer's specification and detail.

#### 2.3 BASE OF FAÇADE DRAINAGE

As per Civil Engineer's specification. Reference product range: ACO Multidrain MD.

#### 2.4 LANDSCAPE DRAINS TO PAVED AREAS

As per Civil Engineer's specification. Reference product range: ACO Multidrain MD.

Landscape drains to have 'Heel Safe' gratings - A grate designed to resist entry of high-heeled shoes, in which the maximum grate hole size in least direction shall be 8mm.

#### 2.5 DRAINAGE IN SERVICE AND PLANT AREAS

Refer to Civil Engineer's specification and detail.

#### 2.6 SPECIALTY PIPE FITTINGS

- A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear erring and corrosion resistant metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
2. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non-conductive materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The dielectric nipples shall be electroplated steel nipple comply with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

## 2.7 FIXING INSULATION TO INTERNAL PIPELINES

Refer to Section 07 21 00 (Thermal Insulation).

- A. Fixing: Secure and neat. Provide continuity at supports and leave no gaps. Fix split pipe insulation with the split on 'blind' side of pipeline.
- B. Method: Mechanical fasteners.
- C. Timing: Do not fit insulation until completion of pipe airtightness and / or leakage testing.

## 2.8 IDENTIFICATION OF INTERNAL RAINWATER PIPEWORK

Refer to Section 07 21 00 (Thermal Insulation).

To be carried out following application of insulation.

- A. Markings: To BS 1710.
- B. Type: Black, with arrows to indicate direction of flow.
- C. Wording: White lettering 'RAINWATER DRAINAGE' on a black background.
- D. Type: Permanent; integral or painted pipe colour, self-adhesive bands or identification clips.
- E. Locations: Junctions, both sides of slabs, bulkheads and wall penetrations.

## SECTION 22 14 00

**PART 3 – EXECUTION**

## 3.1 PIPE INSTALLATION

- A. The pipe installation shall comply with the requirements of the Eurocodes, IS, BS and International Codes, Standards and these specifications.
  - 1. Externally socketed pipes and fittings: Fix with sockets facing upstream.
  - 2. Additional supports: Provide as necessary to support junctions and changes in direction.
  - 3. Vertical pipes: Provide a load-bearing support at least at every storey level. Tighten fixings as work proceeds so that every storey is self-supporting. Wedge joints in unsealed metal pipes to prevent rattling.
  - 4. Wall and floor penetrations: Isolate pipework from structure.
  - 5. Masking plates: Fix at penetrations if visible in the finished work.
  - 6. Expansion joint pipe sockets: Fix rigidly to buildings. Elsewhere, provide brackets and fixings that allow pipes to slide.
- B. Approved Shop Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated on Approved Shop Drawings unless deviations from layout are approved on coordination drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. The piping shall be installed free of sags and bends.
- E. Install piping at indicated slopes.
- F. Install fittings for changes in direction and branch connections.
- G. All pipe runs shall be laid out to avoid interference with other work.
- H. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.
- I. Unless otherwise stated on the documents, minimum horizontal slope shall be 25mm for every 1.22 m of pipe length.
- J. An access point for cleaning and rodding vertical pipe runs shall be provided on every pipe run both vertical and horizontal. At least one access point on each pipe run shall be provided at each storey level.
- K. Branch piping shall be installed from the piping system and connect to all drains and outlets.
- L. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- M. Install fire resistant collars on all piping. Comply with requirements for fire resistant collar devices specified in Section 07 84 00 (Firestopping) and in accordance with the requirements of FM AS 4990 Approval Standard for Firestopping and FM 4924 Approval Standard for Pipe Insulation.

## 3.2 JOINT CONSTRUCTION

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's 'Cast Iron Soil Pipe and Fittings Handbook' for compression joints.
- B. Hub and spigot, cast iron piping with caulked joints shall be joined in accordance with CISPI's 'Cast Iron Soil Pipe and Fittings Handbook' for lead and oakum caulked joints.
- C. Hubless, cast iron piping shall be joined in accordance with CISPI's 'Cast Iron Soil Pipe and Fittings Handbook' for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.
  - 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- F. For PVC piping, solvent cement joints shall be used for joints to ensure a secure and watertight joint construction. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

**3.3 FIRESTOPPING****A. COMPARTMENTATION**

Compartmentation shall comply with the requirements of the Fire Safety Certificate for the building.

B. Where the Compartment walls meets the roof deck and where the roof deck comprises of a double skin insulated sheet, the insulation material shall be of limited combustibility for a width of not less than 300 mm from the firestopping seal in accordance with Section 3.2.5.10 (note A), Technical Guidance / Approved Document B.

D. The junction of the compartment walls/floors with other walls shall maintain the fire resistance of the compartment, i.e. in accordance with Section 3.2.5.8, Technical Guidance / Approved Document – B

E. Junction of the compartment walls/ floors meeting the other walls shall be fire-stopped so as to maintain the fire resistance of the compartment in accordance with Section 3.2.5.8, Technical Guidance / Approved Document B.

F. Openings in compartments shall be shall be limited to the following:

1. Doors which have the appropriate fire resistance and fitted in accordance with appendix B, Technical Guidance / Approved Document B.
2. The passage of pipes, ventilation ducts, chimneys, appliance ventilation ducts or ducts encasing one or more flue pipes, which meet the provisions of in section 3.4 Technical Guidance / Approved Document B.
3. Protected shafts which meet the relevant provisions in section 3.2.7, Technical Guidance / Approved Document B.

**3.4 CAVITY BARRIERS**

The requirements for Cavity Barriers are assessed hereunder in accordance with Table 3.2 and Table 3.3, Technical Guidance / Approved Document B.

**3.5 PROTECTION OF OPENINGS AND FIRESTOPPING OPENING FOR PIPES**

A. If any Pipes pass through compartment walls, floor, stairs, roofing enclosures or cavity barriers they shall be dealt with as follows:

B. Pipes which pass through a compartment wall or compartment floor (unless the pipe is in a protected shaft), or cavity barrier, should meet the appropriate provisions in alternatives A, B or C below.

ALTERNATIVE A: Proprietary Seals (any pipe diameter)

Provide a proprietary sealing system which has been shown by test to maintain the fire resistance of the wall, floor or cavity barrier.

ALTERNATIVE B: Pipes with a restricted diameter.

Where a proprietary sealing system is not used, firestopping may be used around the pipe, keeping the opening as small as possible. The nominal internal diameter of the pipe should not be more than the relevant dimension given in Table 3.4.

The diameters given in Table 3.4 for pipes of specification (b) used in situation (2) assume that the pipes are part of an above ground drainage system and are enclosed as shown in Diagram 22. If they are not, the smaller diameter given I situation (3) should be used instead.

ALTERNATIVE C: Sleeving A pipe of lead, aluminium, aluminium alloy, cement or uPVC, with a maximum nominal internal diameter of 160 mm, may be used with a sleeving of non-combustible pipe as shown in Diagram 23. The specification for non-combustible and uPVC pipes is given in the notes to Table 3.4.

**3.6 FIRE-STOPPING**

A. In addition to any other provisions in this document for fire-stopping:

Joints between elements which serve as a barrier to the passage of fire should be fire-stopped; and all openings for pipes, ducts, conduits or cables to pass through any part of an element which serves as a barrier to the passage of fire should be:

- Kept as few in number as possible.
- Kept as small as practicable.
- Fire-stopped (which in the case of a pipe or ducts, should allow thermal movement).

B. To prevent displacement, materials used for firestopping should be reinforced with (or supported by) materials of limited combustibility in the following circumstances:

In all cases where the unsupported span is greater than 100 mm, and in any other case where non-rigid materials are used (unless they have been shown to be satisfactory by test).

C. Proprietary sealing systems (including those designed for service penetrations) which have been shown by test to maintain the fire resistance of the wall or other element are available.

D. Where pipes penetrate through fire wall, floors, and ceilings the system shall be provided with built in fire sleeves in accordance with BS 476 and Building Regulations APPROVED DOCUMENT B.

- E. The pipe shall have an intumescent fire-sleeve with an appropriate Agrément Certificate or third-party test report.
- F. The fire-sleeves shall have a fire rating compatible with the wall, floor and cavity barrier to which it is fitted.
- G. The fire-sleeves will be fitted in full compliance with the manufacturer's requirements and recommendations.

### 3.7 SPECIALTY PIPE FITTINGS

- A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

### 3.8 PIPE HANGERS, SUPPORTS AND ACCESSORIES

- A. All piping shall be supported according to the International plumbing code, and these specifications.
- B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
  - NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm with 10 mm rod.
  - NPS 3 (DN 80): 1500 mm with 13 mm rod.
  - NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm with 16 mm rod.
  - NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm with 19 mm rod.
  - NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm with 22 mm rod.
- E. The maximum support spacing for horizontal plastic shall be 1.22 m
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.5 m
- G. Plates shall have the following characteristics:
  - Solid or split unplated cast iron.
  - All plates shall be provided with set screws.
  - Height adjustable clevis type pipe hangers.
  - Adjustable Floor Rests and Base Flanges shall be steel.
  - Hanger Rods shall be low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
  - Riser Clamps shall be malleable iron or steel.
  - Roller shall be cast iron.
  - Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centred on and welded to the hanger and support. The shield shall be 100mm in length and be 16 gauge steel. The shield shall be sized for the insulation.
- H. Miscellaneous Materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m for cast iron pipe additional support shall be provided in the centre of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. PENETRATIONS:
  - 1. Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00 (Firestopping) and the requirements of factory Mutual as set out in their Approval Standards. Clearances between raceways and openings shall be completely filled and sealed with the firestopping materials.
  - 2. Water proofing at floor penetrations: Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00 (Sealants).
- K. Piping shall conform to the following:
  - 1. Rain Water Drain and Vent Drain to main stacks:
    - Pipe Size: Minimum Pitch.
    - 80 mm and smaller: 2%
    - 100 mm and larger: 1%

### 3.9 FIELD QUALITY CONTROL

- A. During installation, notify Employer's Representative at least 24 hours before inspection must be made. Perform tests specified below in presence of Employer's Representative.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by Employer's Representative to observe tests specified below and to ensure compliance with requirements.
- B. Re inspection: If the Employer's Representative finds that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by Employer's Representative.
- D. Test storm drainage piping according to procedures of Employer's Representative or, in absence of published procedures, as follows:
  1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced rainwater drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Test Procedure: Test rainwater drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 3.5m head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  5. Prepare reports for tests and required corrective action.

### 3.10 TESTS

- A. Allow for testing of the installation on site during erection and of the completed installation. Flood test required for each outlet. All rectification work required due to non-compliance with specification demonstrated by testing shall be the sole responsibility of the subcontractor and shall be completed without adverse effect on the construction programme.
- B. Rainwater system shall be tested either in its entirety or in sections.
- C. Rainwater Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
  1. If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3.5m head of water. In testing successive sections, test at least upper 3m of next preceding section so that each joint or pipe except upper most 3m of system has been submitted to a test of at least a 3.5m head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
  2. For an air test, an air pressure of 35 kPa (5 psi) gauge shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.
  3. Final Tests: Either one of the following tests may be used.

Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa with a smoke machine. The use of Chemical smoke is prohibited.
- D. Prior to the commencement of construction on site, reports shall be provided, in English, which state for all tests required:
  - The nature, date and location of test.
  - The test institute and author of the report.
  - The accreditation of the test institute.
  - Description of the sample tested.
  - Description of test standard procedure.
  - Description of sample performance under test.
  - Details of any changes made to the sample, pre-tests, or re-tests required to achieve specified performance.
  - Comment on reasons for observed test performance and suitability of the construction to its intended use.

### 3.11 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

**3.12 DOCUMENTATION TO BE SUBMITTED AT HANDOVER STAGE**

Prior to the issue of the Certificate of Practical Completion, the Contractor shall submit to the Construction Manager, 1 number digital copy of the Maintenance Manual for inclusion in the Building Operations and Maintenance Manual (BOM).

A high quality of legibility and presentation is required with each page clearly identified and numbered, as set out in Section 01 10 00 (General Summary of Requirements) and shall fulfil all requirements set out in Section 01 77 00 (Closeout Procedures).

The Maintenance Manual is to include, but not be limited to the following:

1. Set of 'As Built' drawings and material certification.
2. Name, addresses, telephone and facsimile numbers of all manufacturers whose products are incorporated in the foul drainage installation, including all accessories.
3. Details of manufacturers recommended period(s) of maintenance, servicing, cleaning, inspection and replacement, as applicable.
4. Product Technical Data Sheets.
5. Installation Method Statement(s) and any agreed revisions.
6. Certified copies of each report prepared by the manufacturer's representative(s).
7. Warranties: Refer to Clause No 1.12.
8. Details of Warranties. Details of the above warranties to be provided as part of the Tender Submission.
9. Proof of compliance with the Construction Products Regulation (CPR) 2013, when it became mandatory for products within the scope of harmonized European Standards (hENs), to have a Declaration of Performance and to carry the CE Mark.

**3.13 WASTE MANAGEMENT**

- A. As specified in Waste Management Plan and as follows. Separate waste products from contaminants. Do not include drainage pipework, insulation, cement or adhesives or other materials specified in this section with wood, plastic, metal, or any glass fibre, vinyl, decorative paper, or other finish. Place in designated area and protect from moisture and contamination.
- B. Identify manufacturer's policy for collection or return of remaining unused material and packaging material. Institute demolition and construction recycling to take advantage of manufacturer's programs. When such a service is not available, seek local recyclers to reclaim the materials.

**END OF SECTION 22 14 00**