UN Common Services

UN City Changing Rooms Refurbishment

Mechanical Specifications

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Appendix A – Terms and Definitions

1 Introduction

This specification document shall be read in conjunction with the other specifications and the rest of the contract documents.

Unless stated otherwise, the Contractor shall prepare the construction documents and carry out the construction, testing, commissioning and handover as required and described by each provision of this specification and its appendices, whether the provision is written as an obligation of the Contractor or is stated in the imperative form.

1.1 The Project

The project consists in the refurbishment of the changing rooms in the United Nations (UN) City building in Copenhagen, Denmark.

This UN City Changing Room Project includes:

- Demolition works
- Refurbishment of the changing rooms area including access corridor, showers and toilets. This covers an area of approx. 90m² and is located in the basement.

1.2 Codes and standards

Unless expressly stated otherwise, each reference to a code or standard in this document shall mean the latest version of that code or standard.

Compliance with the codes and standards noted in this document is mandatory. This includes any other codes and standards applicable to the project and the respective scope of work even if not listed in the contract documentation, whether noted in general or expressly referenced.

2 Scope

2.1 Mechanical

The mechanical engineering works shall comprise, but not be limited to the following:

- Ventilation
- Heating

The main mechanical services systems include ventilation ductwork, terminal devices and management of interaction of the existing underfloor heating and new floor build-up.

2.2 Public Health

The public health engineering works shall comprise, but not be limited to the following:

- Foul Water Drainage Installation
- Water Installation
- Sprinkler Installation.

3 General Requirements

3.1 Definitions

All relevant terms and definitions are included in Appendix A.

3.2 Codes and Standards

The Contractor shall comply with all applicable and relevant standards indicated, but not limited, to those within each section of the following specification. The latest applicable version of these specifications shall be used. These are:

- Bygningsreglementet 2018 (BR18)
- DS 428:2018 – Code of Practice for technical measures for fire protection of ventilation systems
- DS 447:2013 - Ventilation in buildings – Mechanical, natural and hybrid ventilation systems
- DS EN ISO 16890 – Air filters for general ventilation – Part 1
- DS EN 1886 – Ventilation for buildings – Air handling units – Mechanical performance
- DS EN 13053 - Ventilation for buildings – Air handling units – Rating and performance for units, components and sections
- EN 779:2012 - Particulate air filters for general ventilation - Determination of the filtration performance
- DS 134 - Identification colours and letter codes to be used for drawings and pipelines
- DS 439 - Code of Practice for domestic water supply installations
- DS 432 - Norm for afløbsinstallationer.
- SBi-255, 256, 257 – Afløbsinstallationer.
- SBi-234, 335, 236 – Vandinstallationer.
- DS DS/EN 1295 - Structural design of buried pipelines under various conditions of loading
- DS/EN 15012 - Plastrørsystemer – Systemer til afløb i bygninger – Ydeevne af rør, formstykker og samlinger
- DS/EN 15014 - Plastrørsystemer – Jordlagte og ikke jordlagte rørsystemer til vand og andre væsker under tryk – Ydeevne af rør, formstykker og samlinger
- DS/EN 1566 - PVC-C-rørsystemer til afløb (høj og lav temperatur) i bygninger
- DS/EN 1124 - Pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for waste water systems
- DS/EN 1717 - Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow.
- DS/EN 12259 – Fixed Firefighting systems
- DBI 251/4001 – Sprinkleranlæg.

3.3 Requirements for Contractor´s designed elements

This section defines the requirements for Contractor's designed elements. The Contract shall submit the relevant design package to the Employer for their review for approval.

3.3.1 Water Installations

The Contractor shall determine the position of existing water mains within the UN Basement, either through acquisition and study of as-built documents or a site survey and shall provide these as an updated drawing for review and approval of the Engineer. Once the exact nature of the water installation is confirmed, the Contractor shall develop the design for final connection details and routing to the water mains.

3.3.2 Fire Protection

The Contractor shall determine the position of existing sprinkler mains within the UN Basement, either through acquisition and study of as-built documents or a site survey and shall provide these as an updated drawing for review and approval of the Engineer. Once the exact nature of the installation is confirmed, the Contractor shall develop the design for final connection details and routing to the water mains.

4 Building Elements Specifications

4.1 Ventilation

The Contractor shall modify the modulate fans settings for Air Handling Units serving the Channing Rooms, the as build drawing V-6-1-K-3250 refer to K6-VE11_BRSO3 and K6-VE11_BRSO4.

4.1.1.1 Standards & Regulations

The Contractor shall ensure that the Air Handling Unit follow the following standards:

- DS 428:2018 – *Code of Practice for technical measures for fire protection of ventilation systems*
- DS 447:2013 - *Ventilation in buildings – Mechanical, natural and hybrid ventilation systems*
- DS 452 - *Thermal insulation of technical service and supply systems*
- DS EN ISO 16890 – *Air filters for general ventilation – Part 1*
- DS EN 1886 – *Ventilation for buildings – Air handling units – Mechanical performance*
- DS EN 13053 - *Ventilation for buildings – Air handling units – Rating and performance for units, components and sections*
- EN 779:2012 - *Particulate air filters for general ventilation - Determination of the filtration performance*
- DS EN ISO 12944-2:2017 - *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments*
- DS 134 - *Identification colours and letter codes to be used for drawings and pipelines*

4.1.1.2 Fans

The Fans performance shall be modulated to account for the ventilation rate of 10 Air Changes per hour for the refurbished Changing Room.

4.1.1.3 4.4Technical InsulationAir flow requirements

The unit's flow rate shall be set to handle the constant volume during occupation of the changing room the Air flow required are 260 l/s for the Upper Changing room and 250 l/s for the Lower Changing room for supply and return individually. The measurement of the flow rates shall be performed at the air terminals within the both Changing rooms and the toilet shall be provided with 12 l/s of the extract and the rest shall be extracted for the shower area.

Flow rates shall follow the following tolerances:

Table 1 - Flow rates tolerances

Description	Min deviation from design flow	Max deviation from design flow
Air flow rate tolerances	-0%	+10%

4.1.1.4 Sound requirements

Furthermore, the contractor shall allow for noise tests. Full octave band sound power data shall be provided for the AHU and casing break-out, at representative operating points and system conditions.

4.1.1.5 As-built

Documentation for the modified settings of the air handling unit shall be delivered in form of as built testing documents.

4.2 Ductwork and ductwork fittings

4.2.1 Materials and Products

The Contractor shall supply, install and test all ductwork and ductwork fittings as shown on the drawings, described herein.

Exposed surfaces of outside ductwork, and all associated fittings, shall comply with corrosion class C4 according to DS EN ISO 12944-2.

All ductwork and ductwork fittings shall fully comply with European, Danish or International standards and carry a third-party approval certification CE pipes. They shall be delivered to site correctly packaged with manufacturer's traceability information.

The Contractor shall provide the products as per the specifications listed in the subsections below.

4.2.1.1 Standards & Regulations

The Contractor shall ensure all ductwork and ductwork fittings follow the following standards:

- DS 134 - *Identification colours and letter codes to be used for drawings and pipelines*
- DS 447:2013 - *Ventilation in buildings – Mechanical, natural and hybrid ventilation systems*
- BESA DW 144 – *Specification for Sheet Metal Ductwork*
- EN 13779 - *Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems*
- EN 13030 - *Ventilation for buildings - Terminals - Performance testing of louvres subjected to simulated rain*

- DS EN ISO 1461 - *Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods*
- DS EN ISO 12944-2:2017 - *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments*
- BESA TR/19 - *Guide to Good Practice - Internal Cleanliness of Ventilation Systems*

4.2.1.2 Attenuator

The following attenuation bands must be achieved:

Octave band (Hz)	**63**	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
attenuation	1	5	10	22	39	37	26	16

4.2.1.3 Supply diffuser

The supply diffuser must be of a simple, sleek design and comply with the following requirements:

- **Pressure drop:** <50 Pa
- **Sound pressure:** <25 dB(A)
- **Colour:** white
- **Material:** Diffusers in the changing room and shower area shall able to resist the elevated moisture levels.

4.2.1.4 Extract diffuser

The extract diffuser must be of a simple, sleek design and comply with the following requirements:

Pressure drop: <50 Pa

Sound pressure: <25 dB(A)

Colour: white

Material: Diffusers in the changing room and shower area shall able to resist the elevated moisture levels.

4.2.1.5 Hangers & Supports

All ductwork shall be securely held and aligned.

Support spacing and loads shall include all ductwork system components which cannot be provided with individual supports such as acoustic insulation or fire cladding and balancing dampers.

The size strength and materials used for external ductwork supports shall be suitable for the ductwork, system components, insulation, cladding and prevailing external conditions. Cross bracing shall be provided between adjacent supports where necessary to resist wind loading.

Duct hangers wherever exposed in humid air or to view shall be protected by a suitable paint scheme or hot dip galvanizing after manufacture.

4.2.2 Colours

Equipment are given identification colours in accordance with DS 134. End fittings like air terminals/diffusers and grilles shall not be colour coded or tagged.

4.2.2.1 Access

Access openings shall be located, arranged and sized to permit full access required for maintenance. Inspection covers shall permit associated equipment item to be viewed.

Access openings and inspection covers shall be rigidly framed, with gasketed airtight covers designed for easy removal and accurate relocation and fixing.

Self-tapping screws shall not be used.

4.2.3 Execution

4.2.3.1 Installation

Access hatches shall be provided as per DW144, DW172 and specifically access hatches shall be allowed in the ductwork at all louver connections to facilitate louver cleaning and inspection.

The ductwork system shall be designed to have a low leakage level and shall comply with class C in DS 447:2013.

All necessary ductwork, control, isolating, fire, smoke and balancing dampers, grilles and diffusers to form complete air distribution systems shall be provided.

Sheet metal for fabrication shall be new, smooth and free from blisters, pits and imperfections in coating. Galvanising shall be to DS EN ISO 1461.

Holes in main ducts for branches shall not be greater than the branch size.

Duct sizes are clear internal required airway dimensions. Allowance shall be made for any acoustic linings and their coverings. There shall be no obstructions or rough surfaces within any ductwork.

Duct branches and equipment items shall be supported locally to prevent distortion.

Flexible connections shall be made between ductwork and fans and other equipment items.

Access shall be maintained to ductwork system components which require inspection, cleaning, or adjustment.

At every point of duct penetration of the building envelope, a sealed louvre, weather cowl or protective flashing and full closure plate shall be provided to prevent ingress of water.

All metal fasteners shall be entirely compatible with the materials used.

Circular radius pressed bends shall have one diameter throat radius.

Tapers for circular ducts shall not exceed 22.5°C.

Self-adhesive tapes shall not be used. Glass fibre reinforced tape only shall be used and shall be fixed with spray-applied adhesive at site. The use of tape shall be restricted to the completion of site joints in extremely difficult locations only where alternative methods are not possible. A record of these locations shall be submitted.

Ductwork connections to building openings, external louvres, grilles etc. shall have compatible flanges for airtight fixing.

Test holes shall be accessible for airflow measurement, system balancing, testing and commissioning.

Ductwork shall be cleaned without detrimental effect to finished areas.

Ductwork installations shall be rigid, free from sway, drumming and movement. Ductwork shall be true-to-size and accurately aligned.

Connections to associated equipment and other fittings must also be in proper alignment, to prevent turbulence and associated noise and vibration.

A Medium cleanliness quality class as defined in TR/19 shall be achieved for all ventilation systems unless otherwise specified. Testing shall be carried out on all systems to demonstrate that the acceptable dust accumulation levels are achieved.

Ductwork protection, delivery and installation shall meet TR/19 Intermediate PDI unless otherwise specified.

Provisions made for access for cleaning shall be generally to TR/19. Specialist cleaning contractor shall confirm whether additional provisions are required.

4.2.4 Control

No samples required.

The Contractor shall submit a technical submittal complete with all manufacturer information to the Engineer for final approval of the material prior to any orders being placed.

4.3 4.44.4Technical Insulation Underfloor Heating

4.3.1 Materials and Products

An existing underfloor heating system provide heating to the Changing room. This includes a manifold located in the lower installation void, as indicated on the drawings V-X-4-X-3ME5.

4.3.2 Standards & Regulations

The heating installation shall ensure to comply with the following standards:

- DS 469 - *Heating and cooling systems in buildings*

4.3.3 General Requirements

As part of the Contractor's initial investigations they shall carry out investigations within the floor build up within the changing room. This is to understand the build up above and below the installed underfloor heating system. This investigation shall be carried out around Loop 3.

The shower areas are provided with structural build up on top of the heated floor, the contract shall ensure that this new floor build-up function with the underfloor heating and is capable of providing heating to the room during occupied areas.

The Contractor shall update the Control for the underfloor heating system to account for the new floor build-up in the shower area and the new room layout put the loop 3 out in the corridor according to drawing V-X-4-X-3ME5, and should therefore be controlled as part of the corridor heating scheme or turned off.

The heating scheme for the changing room shall ensure a comfortable temperature 22±2° C.

The Contractor shall determine User Control panels and provide similar control panels and provision for the refurbished Changing Room.

4.4 Technical Insulation

4.4.1 General Requirements

All technical insulation shall follow the requirements set out in DS 452.

Insulation shall be laid out and installed with adequate space for the insulation. The insulation shall not be squeezed at single points such as the entry point.

The Contractor shall be responsible for final selections of insulation thicknesses in accordance with the relevant insulation specification.

Pipework insulation shall be continuous to mitigate surface condensation risks.

4.4.2 Standards & Regulations

The Contractor shall ensure that the installation complies with the following:

- DS 452 – *Thermal insulation of technical service and supply systems*

4.4.3 Materials and Products

Outside thermal insulation shall be installed with a rigid metal surface. Valves, tap points gauges, sensors etc. shall be installed with as a demountable casing consisting of the rigid metal and associated insulation.

Condensation insulation shall be installed with a vapour barrier diffusion resistance of at least 500*10^9 Pa*m²*s/kg.

All pipe hangers/supports shall be of the insulated type.

4.4.4 Execution

Pipework may not be insulated before all pipework on the specific system, such as DCW or DHW, has been finalised.

Valves such as DPCVs, IVs, 2-PVs shall all be insulated with demountable rigid insulation forms manufactured by the same manufacturer and to the specific valve.

Appropriate cut outs shall be made to any test points and pressure gauges.

4.4.5 Control

A visual inspection of the finished insulation shall be performed after all insulation has been finished and before architectural finishes/cladding are installed.

The visual inspection must be done by another party than the installer and a written acceptance note must be submitted after inspection no later than two weeks.

The Contractor shall submit a technical submittal complete with all manufacturer information to the Engineer for final approval of the material prior to any orders being placed.

4.5 Drainage Pipes

4.5.1 Materials and Products

The Contractor shall supply, install and test all foul water drainage pipes as shown on the drawings, described herein.

All pipes shall fully comply with European, Danish or International standards and carry a third-party approval certification CE pipes. They shall be delivered to site correctly packaged with manufacturer’s traceability information.

All pipes shall be marked with the following information at a minimum:

- Manufacturer's Name and Factory Identifier
- CE Mark
- Relevant EN or DS standard number
- Name of Third-Party Approver CE
- Year of manufacture.

4.5.2 Standards & Regulations

The Contractor shall ensure that the new drainage pipework follow the following standards:

- DS 432 - *Norm for afløbsinstallationer*.
- SBi-255, 256, 257 – *Afløbsinstallationer*.
- DS/EN 752 - *Drain and sewer systems outside buildings – Sewer system management*
- DS/EN 1295 - *Structural design of buried pipelines under various conditions of loading*
- DS/EN 15012 - *Plastrørsystemer – Systemer til afløb i bygninger – Ydeevne af rør, formstykker og samlinger*
- DS/EN 15014 - *Plastrørsystemer – Jordlagte og ikke jordlagte rørsystemer til vand og andre væsker under tryk – Ydeevne af rør, formstykker og samlinger*
- DS/EN 1566 - *PVC-C-rørsystemer til afløb (høj og lav temperatur) i bygninger*
- DS/EN 1124 - *Pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for wastewater systems*

4.5.2.1 General Requirements

The foul water drainage pipes shall be complete with all necessary offsets, bends, branches, shoes/connections to gullies or drains to provide a complete rainwater drainage system.

All pipe above ground shall be provided with a 15‰ inclination unless otherwise specified.

Pipes shall be provided with bearings every 700 mm.

4.5.2.1.1 Foul Water pipes

New foul waterpipe shall be delivered as PVC pipes, the contractor shall investigate the existing pipe material and provide the new pipework in a similar material in the event that the material deviates from PVC.

4.5.2.1.2 Sizes

All pipes shall be metric sizes. Imperial sizes are not acceptable. If installed, the contractor shall remove the full imperial installation and replace with metric at his own expense.

4.5.2.1.3 Colours

Drainage pipes are given identification colours in accordance with DS 134.

Drainage pipe marked brown with a “S” label.

4.5.2.1.4 Joints

Only joint rings supplied by the manufacturers of the pipes shall be used. Joints shall not be made within the thickness of the structure.

4.5.3 Execution

During the construction of the shower floor build-up connection to the existing foul water drainage system is carried out.

Spigots, sockets and joint rings shall be thoroughly cleaned before laying.

4.5.4 Control

The Contractor shall deliver a sample of the pipe material for the Client and engineers review to insure conformity with the existing rainwater pipework.

Pipework shall be clear of debris prior to testing.

Upon completion a CCTV survey shall be carried out to demonstrate cleanliness of the pipework.

Tests shall be made with air or water. A further water test shall be made on completion of backfilling and surface reinstatement

The Contractor shall submit a technical submittal complete with all manufacturer information to the Engineer for final approval of the material prior to any orders being placed.

4.6 Gullies

4.6.1 Materials and Products

The Contractor shall supply, install and test channel drains as shown on the drawings, described herein.

All channel drains shall fully comply with European, Danish or International standards and carry a third-party approval certification CE.

4.6.1.1 Standards & Regulations

The contractor shall ensure that the new drainage channels comply with the following standards:

- DS 432 - *Norm for afløbsinstallationer*
- SBi-255, 256, 257 – *Afløbsinstallationer*

4.6.1.2 Channel drains

Channel drains shall procure and install a similar product to *Modulo 30 TAF* or other low height channel drain cable of draining 0.4 l/s per adjacent shower the Contractor shall confirm that this is indeed the correct product and provide similar new channel drains. All surfaces in the wetzone shall slope towards the channel drain.

4.6.1.2.1 Sizes

All sizes shall be metric sizes. Imperial sizes are not acceptable. If installed, the contractor shall remove the full imperial installation and replace with metric at his own expense.

4.6.1.2.2 Colours

The colours of all new gullies and channel drains shall match those of the existing installation.

4.6.2 Control

The Contractor shall provide a sample section of the channel drain .

The Contractor shall submit a technical submittal complete with all manufacturer information to the Engineer for final approval of the material prior to any orders being placed.

4.6.3 Execution

Channel drain systems shall be complete with all necessary components to provide a fully watertight system.

Channel drains shall be with a fixed fall to the outlets.

4.6.3.1 Channel drains

Channel drains shall be carried out and coordinated with the final grades of the floor finish. The connection to the vertical outfall shall be watertight.

All channel drains shall be in flush with the final grade.

4.7 Domestic Water

The domestic water system comprises of pipework and valves for both Domestic hot- and cold water.

1.1.1 General Requirements

Domestic water system shall be provided in accordance with:

- DS 439 - *Code of Practice for domestic water supply installations*
- SBi-234, 335, 236 – *Vandinstallationer.*
- DS/EN 1717 - *Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow.*

1.1.2 Materials

The Contractor shall supply, install and test all water installation pipes as shown on the drawings, described herein.

All pipes shall fully comply with European, Danish or International standards and carry a third-party approval certification CE pipes. They shall be delivered to site correctly packaged with manufacturer's traceability information.

All pipes shall be marked with the following information at a minimum:

- Manufacturer's Name and Factory Identifier
- CE Mark
- Relevant EN or DS standard number
- Name of Third-Party Approver

4.7.1.1 General Requirements

The domestic water pipes shall be complete with all necessary offsets, bends, branches, shoes/connections from the water mains within basement to all fixtures within the changing rooms.

Pipes shall be provided with bearings every 2500 mm.

Wherever possible for the domestic hot water system, thermal expansion or contraction shall be accommodated by use of pipe loops, sets or changes of direction. Where such methods are not practicable, sheathed corrugated bellows expansion joints to suit the application shall be used.

All expansion devices and guides shall be installed strictly in accordance with the manufacturer's instructions.

Pipe guides shall be provided on both sides of expansion joints or loops.

Guides shall be rigidly fixed and allow free movement for expansion, without excessive tolerances, in the correct alignment. A 3mm clearance shall be left between each guide and pipe wall or covering surface.

All fixtures with hot water shall be provide with a hot water mixing unit that ensures that the outlet temperature is no higher than 65°C to avoid scolding. The Contractor shall ensure that the pipe route from the mixing valve to the shower head is not so far that it poses a risk for legionella growth.

All pipes connecting to fixtures shall be provided with isolation valves to facilitate isolation of the fixture to allow for maintenance and replacement.

The Contractor shall provide the taps for wash hand basin in toilets as Grohe Eurosmart håndvaskarmatur med bundventil and for the tap in the staircase outside the changing room as a Vola - HV1+170 or a similar products.

Showers fixtures are carried out embedded in the wall, therefor the Contractor shall provide the isolation valves and hot water mixing units within the ceiling void, to ensure accessibility of all valves. The Contractor shall provide the shower head fixtures as a Hansgrohe Raindance hovedbruser or a similar product.

Shower fixtures shall be activated by the push of a button, which starts an automatic shut-off delayed by approximately 30 sec. The hot water temperature shall be adjustable either at the tap or at mixing valve. The Contractor shall provide the time delaying fixture as a Tempo-stop shower valve or a similar product.

4.7.1.1.1 Domestic water pipes

New Domestic water pipe shall be delivered as stainless-steel pipes, the contractor shall investigate the existing pipe material and provide the new pipework in a similar material in the event that the material deviates from stainless-steel.

4.7.1.1.2 Sizes

All pipes shall be metric sizes. Imperial sizes are not acceptable. If installed, the contractor shall remove the full imperial installation and replace with metric at his own expense.

4.7.1.1.3 Colours

Domestic water pipes are given identification colours in accordance with DS 134.

Domestic cold water pipe marked light blue with a “BK” label.

Domestic hot water pipe marked light blue with a “BV” label.

4.7.1.1.4 Joints

Only joint rings supplied by the manufacturers of the pipes shall be used. Joints shall not be made within the thickness of the structure.

4.7.2 Execution

Spigots, sockets and joint rings shall be thoroughly cleaned before laying.

4.7.3 Control

Pipework shall be clear of debris prior to testing.

Tests shall be made with air or water. A further water test shall be made on completion of backfilling and surface reinstatement

The Contractor shall submit a technical submittal complete with all manufacturer information to the Engineer for final approval of the material prior to any orders being placed.

4.8 Sprinklers

1.1.3 General Requirements

Sprinkler system shall be provided in accordance with:

- DS/EN 12259 – *Fixed Firefighting systems*
- DBI 251/4001 – *Sprinkleranlæg*.

1.1.4 Materials

The Contractor shall supply, install and test all water installation pipes as shown on the drawings, described herein.

All pipes shall fully comply with European, Danish or International standards and carry a third-party approval certification CE pipes. They shall be delivered to site correctly packaged with manufacturer's traceability information.

All pipes shall be marked with the following information at a minimum:

- Manufacturer's Name and Factory Identifier
- CE Mark
- Relevant EN or DS standard number
- Name of Third-Party Approver.

4.8.1.1 General Requirements

The sprinkler pipes shall be complete with all necessary offsets, bends, branches, shoes/connections sprinkler mains within basement to all sprinklers.

Pipes shall be provided with bearings of A2-s1,d0 fire resistance and be provided maximum 900 mm from sprinklers and maximum 4000m for the remain pipework.

All welding shall be in accordance with the description in DBI 251/4001.

4.8.1.1.1 Sprinkler pipes

New sprinkler pipe shall be delivered as steel pipes, the contractor shall investigate the existing pipe material and provide the new pipework in a similar material in the event that the material deviates from steel.

Sprinkler shall be provided with isolation valve locked in the open position.

The new branch shall be provided with an isolation valves locked in the open position and be provided with drain valves to facilitate drainage of the new branch.

Flushing valves shall be provided at the end of distribution pipes.

4.8.1.1.2 Sizes

All pipes shall be metric sizes. Imperial sizes are not acceptable. If installed, the contractor shall remove the full imperial installation and replace with metric at his own expense.

4.8.1.1.3 Colours

The sprinkler system are given identification and labelling in accordance with DBI 251/4001, section 16.

4.8.1.1.4 Joints

Only joint rings supplied by the manufacturers of the pipes shall be used. Joints shall not be made within the thickness of the structure.

All pipe joint must be approved.

4.8.2 Execution

Spigots, sockets and joint rings shall be thoroughly cleaned before laying.

4.8.3 Control

Pipework shall be clear of debris prior to testing.

Tests shall be made with air or water. A further water test shall be made on completion of backfilling and surface reinstatement

The Contractor shall submit a technical submittal complete with all manufacturer information to the Engineer for final approval of the material prior to any orders being placed.

Appendix A

Term	Meaning
Employer	The **Employer** is the party responsible for coordinating the input of the **Employer** and the **Employer**'s appointed consultants including Consultants involved in preparing the design intent information for the Works and others as necessary in relation to the Works. It includes any of these parties when directed and instructed by the **Employer**.
Contractor	Includes all sub-consultants, sub-**Contractors**, and suppliers working under the **Contractor** either directly or indirectly with respect to the Works. References to 'he' and 'his' in this Specification refer to the **Contractor** unless the context of the clause indicates otherwise.
Detailed Design	Design information produced by the **Employer**.
Submissions	Information supplied by the **Contractor** including, models, samples, prototypes, mock-ups, digital mock-ups, 3d surface models, tests, reports, certificates, permissions and approvals, method statements that are to be submitted to the **Employer** for review and approval.
Project Plan	Information supplied by the **Contractor** including, project design, testing, fabrication, shipping and installation, that are to be submitted to the **Employer** for review and approval.
Visual Mock Up Drawings	Drawings produced by the **Contractor** illustrating his detail design proposals for the Visual Mock Up (VMU). These are to be submitted to the **Employer** for review and approval.
Performance Mock Up Drawings	Drawings produced by the **Contractor** illustrating his detail design proposals for the Performance Mock Up (PMU). These are to be submitted to the **Employer** for review and approval.
Fabrication drawings	Drawings produced by the **Contractor** containing fabrication and process information for use in the manufacture and factory assembly of components for the Works, all in accordance with the approved Construction drawings. These are not required for review and approval, but should be available for inspection and audit if requested.
Installation drawings	Drawings produced by the **Contractor** containing installation and process information for use in the manufacture and site assembly of components for the Works, all in accordance with the approved Construction drawings. These are not required for review and

Term	Meaning
	approval, but should be available for inspection and audit if requested.
As-built information	Information supplied by the **Contractor** as part of the O&M manual including drawings, photographs, descriptions, tests and reports. These are to be submitted to the **Employer** for review and approval.