

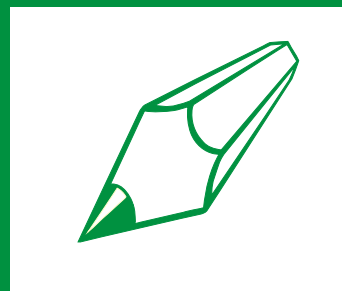
MINIKIN

Specification Guide

5th Edition

A Guide to the Specification of Flexible Connectors, Expansion Joints, Guides, Anti-Vibration Mounts, Air & Dirt Separators and Related Equipment for Pipework Systems

With special reference to the
Building Services Industry



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Certificate No. Q 5468

A Guide to the Specification of Flexible Connectors, Expansion Joints, Guides, Anti-Vibration Mounts, Air & Dirt Separators and Related Equipment for Pipework Systems

From N.Minikin & Sons Ltd.

These standard specifications have been compiled to provide the specifier with a comprehensive guide to the correct specification clauses required for flexible connectors, expansion joints, pipe guides, anti-vibration mounts, air & dirt separators and related equipment for the building engineering services industry.

It is not necessary to use all clauses all of the time. We recommended that the specifier considers each clause with particular reference to the design of the project and to the types and model references of equipment required or advised by ourselves.

For a quick guide use the general clauses. For a more detailed guide use the individual specifications.

We reserve the right to alter any information detailed in this guide.

E&OE



Certificate No. Q 5468

This specification guide presented by:

MINIKIN STANDARD SPECIFICATIONS

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GENERAL CLAUSES

The M.S.C. shall make due allowance for thermal expansion, noise, vibration of pipework & plant, automatic air removal and shall provide expansion joints, guides, flexible connectors, anti vibration mounts, air & dirt separators and related equipment as required.

These shall be as follows:-

Rubber Flexible Connectors (see page 5 for more details)

Chlorobutyl units shall be type **BB untied** or **tied** to suit the working pressure and plant mounting detail.

E.P.D.M units shall be type **EE untied** or **tied** to suit the working pressure and plant mounting detail.

E.P.D.M units to DIN4809 shall be type **RR untied** or **tied** to suit the working pressure and plant mounting detail.

Butyl/E.P.D.M units to DVGW shall be type **R untied** or **tied** to suit the working pressure and plant mounting detail.

Full Face units shall be type **FF untied** or **tied** to suit the working pressure and plant mounting detail.

Corrugated Stainless Steel Braided Flexible Connectors (see page 6 for more details)

Flanged units shall be type **BBF** or **BBFN** for steel or copper pipe.

Screwed units shall be type **BBT** or **BBTN** for steel or copper pipe.

Copper tailed units shall be type **BBC** for copper pipe.

Stainless Steel Expansion & Contraction Joints (see page 7 for more details)

Flanged axial units shall be type **BAF** or **BAFN** for steel or copper pipe.

Screwed axial units shall be type **BAT** or **BATN** for steel or copper pipe.

Fully articulated units shall be type **BLF** or **BLFN** for steel or copper pipe.

Double hinged units shall be type **BDHF** or **BDHFN** for steel or copper pipe.

Angular units shall be type **BHF** or **BHFN** for steel or copper pipe.

Gimbal units shall be type **BGF** or **BGFN** for steel or copper pipe.

Braided lateral units shall be type **BBF** or **BBFN** for steel or copper pipe.

Building Movement Joints (see page 8 for more details)

Flanged braided units shall be type **BBF** or **BBFN** for steel or copper pipe

Screwed braided units shall be type **BBT** or **BBTN** for steel or copper pipe

Stainless steel restrained bellows units shall be types **BLF**, **BDHF**, **BHF** or

BGF for steel pipe and types **BLFN**, **BDHFN**, **BHFN** or **BGFN** for copper pipe

Pressure balanced bellows units shall be type **BPB**

Quick Release Couplings (see page 9 for more details)

Ball & groove locking mechanism units shall be type **BGC**

Screw thread locking mechanism units shall be type **STC**

Cam action locking mechanism units shall be type **CAC**

Gas & Oil Installation Braided Flexible Connectors (see page 10 for more details)

Flanged braided units shall be type **BBF** or **BBFN** to suit the fuel type and pipeline material.

Screwed braided units shall be type **BBT** or **BBTN** to suit the fuel type and pipeline material.

Catering Equipment Connectors (see page 11 for more details)

Flexible connector with integral quick release coupling to BS669 shall be type **CATG** for gas service.

Flexible connector shall be type **CATW** for water service.

Quick release coupling shall be type **CATQ** for water service.

Ball valves shall be type **BBVG** or **BBVW** for gas or water service.

Fan Coil, Chilled Ceiling & Chilled Beam Connectors (see page 12 for more details)

Fancoil flexible hose connectors shall be type **FCH** or **FCHA** for heating or chilled water service in steel pipework.

Fancoil flexible hose connectors shall be type **FCHN** or **FCHNA** for heating or chilled water service in copper pipework.

Fancoil quick release couplings shall be type **FCQ** for heating and chilled water service.

Chilled Ceiling & Chilled Beam flexible hose connectors shall be type **CHH** for chilled water service.

Rubber flexible hose connectors tested by BSRIA shall be type **RH** or **RHA** for heating or chilled water service.

Rubber Expansion & Contraction Joints (see page 13 for more details)

Axial rubber units shall be type **BB untied**

Single articulated rubber units shall be type **BB tied** with hemispherical tie bar assembly.

Angular rubber units shall be type **BB angular** with special hinge assembly.

Exhaust Expansion Joints

(see page 14 for more details)

Single axial units shall be type **BAFX**

Double units shall be type **BDFX**

Fully articulated units shall be type **BLFX**

Double hinged units shall be type **BDHFX**

Angular units shall be type **BHFX**

Gimbal units shall be type **BGFX**

Single articulated units shall be type **BFCX**

Braided lateral units shall be type **BBFX**

Tailor Made Insulation Covers

(see page 15 for more details)

Tailor made covers shall be type **TMC**

Flexible Duct Connectors

(see page 16 for more details)

Flexible duct connectors shall be type **FDC**

Pipe Guides and Skids

(see page 17 for more details)

Tubular slide guides shall be type **TSG** or **TSGN** for steel or copper pipe.

Light duty pipe slide guides shall be type **PSGL** or **PSGLN** for steel or copper pipe.

Medium duty pipe slide guides shall be type **PSGM** or **PSGMN** for steel or copper pipe.

Heavy duty pipe slide guides shall be type **PSGH** or **PSGHN** for steel or copper pipe.

Light duty pipe skids shall be type **PSL** or **PSLN** for steel or copper pipe.

Medium duty pipe skids shall be type **PSM** or **PSMN** for steel or copper pipe.

Heavy duty pipe skids shall be type **PSH** or **PSHN** for steel or copper pipe.

Roller, chair and guide assemblies shall be type **RCG** or **RCGN** for steel or copper pipe.

Saddle guides shall be type **SGS** or **SGC** for steel or copper pipe.

Inertia Bases and Mounts

(see page 18 for more details)

Inertia base & mount package shall be type **IBMP**

Pipework & Equipment A.V. Hangers

(see page 19 for more details)

Spring hangers shall be type **HS**

Positioned spring hangers shall be type **HPS**

Spring & rubber hangers shall be type **HSR**

Positioned spring & rubber hangers shall be type **HPSR**

Neoprene rubber hangers shall be type **HR**

Anti Vibration Mounts

(see page 20 for more details)

Open spring mounts shall be type **MOS** to suit the plant supported

Closed spring mounts shall be type **MCS** to suit the plant supported

Restrained spring mounts shall be type **MROS** to suit the plant supported

Heavy duty spring mounts shall be type **MROS-HD** to suit the plant supported

Neoprene rubber mounts shall be type **MNR** to suit the plant supported

Neoprene ribbed rubber mat shall be type **NRP**

Neoprene waffle rubber mat shall be type **NWP**

Neoprene ribbed rubber and cork mat shall be type **NCN**

Air and Dirt Separators

(see page 21 for more details)

Centrifugal Air Separators shall be type **SCAF** with flanged ends or type **SCAW** with weld ends

Microbubble Air Separators shall be type **SMAF** with flanged ends, type **SMAT** with threaded ends, or type **SMAW** with weld ends

Microbubble Air and Dirt Separators shall be type **SMADF** with flanged ends or type **SMADW** with weld ends

Dirt Separators shall be type **SDF** with flanged ends, and type **SDFI** with flanged ends and insulation

Automatic Air Vents

(see page 22 for more details)

Automatic Air Vents shall be type **SAAV-S**

All equipment shall be 'EMFLEX' units by:-

N Minikin & Sons Ltd of Harrogate.

Tel:01423 889845 Fax:01423 880724 Email:minikin@dia1.pipex.com

The contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection, design or application of the above equipment.

RUBBER FLEXIBLE CONNECTORS

The M.S.C. shall make due allowance for vibration of plant items and shall provide rubber flexible connectors as required.

These shall be as follows :-

Flexible connectors shall be provided with flanged ends. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure. They shall be supplied with anti-vacuum support rings as required.

Standard types and model references are as follows :-

For chilled water and heating services,

Chlorobutyl rubber flexible connectors shall be type **BB** comprising a single sphere membrane of nylon fabric reinforced chlorobutyl rubber with wire reinforced collars and be fitted with carbon steel flanges. They shall be suitable for a design life of up to 10 years depending on working temperature and pressure.

E.P.D.M. rubber flexible connectors shall be type **EE** comprising a single sphere membrane of nylon fabric reinforced EPDM rubber with wire reinforced collars and be fitted with carbon steel flanges. They shall be suitable for a design life of up to 10 years depending on working temperature and pressure.

High Performance types and model references are as follows :-

For heating services,

E.P.D.M. rubber flexible connectors shall be type **RR** comprising a single sphere membrane of high tensile polymer textile reinforced EPDM rubber with wire reinforced collars and be fitted with carbon steel flanges. They shall be suitable for a design life of 10 years when operating at combined maximums of 100°C & 10Bar and shall be in accordance with DIN4809 for use on heating plant.

For domestic water services,

Butyl/E.P.D.M. rubber flexible connectors shall be type **R** comprising a single sphere membrane of nylon fabric reinforced Butyl/EPDM compound rubber with wire reinforced collars and be fitted with carbon steel flanges. They shall be suitable for a design life of 10 years when operating at combined maximums of 60°C & 10Bar and shall be in accordance with DVGW for use on drinking water applications.

Types **BB**, **EE**, **RR** and **R** shall be classed as :-

UNTIED for working pressures up to 4 bar, unless the pipe is restrained.

TIED with top hat washer tie-bar assembly up to 10 bar.

TIED with hemi-spherical washer tie-bar assembly up to 16 bar.

Full face rubber flexible connectors shall be type **FF** comprising a single membrane of reinforced rubber finishing with a full face, behind which are carbon steel backing flanges. The rubber compound used shall be selected to suit the application.

Type **FF** shall be classed as:-

UNTIED for working pressures up to 4 bar, unless the pipe is restrained.

TIED for working pressures exceeding 4 bar.

All rubber flexible connectors shall not be used on water service temperatures above 100°C.

All rubber flexible connectors shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.

Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that vibration of plant is accommodated the M.S.C. shall :-

a) Connect to items of plant in such a way that no stress is placed on the plant or connector.

b) Support service pipework independently so that no load is placed on the flexible connector.

c) Install flexible connectors in full accordance with the manufacturer's recommendations and instructions.

d) Install flexible connectors between items of identical diameter. No bushing or other reductions shall be made at connector positions.

e) Ensure that the maximum movement of the flexible connectors do not exceed those stated in the '**EMFLEX**' catalogue.

f) Ensure that the bore and face of the pipework / plant mating flanges match the bore and face of the rubber flexible connector.

g) Provide flexible connectors at line size.

h) Supply and install tailor made covers (type TMC) where necessary to insulate the flexible membrane or to act as a 'fireguard' in the event of fire.

i) Provide earth continuity connection where required as the flexible rubber membrane effectively prevents good electrical continuity along the pipe. These shall be looped for flexibility.

j) Ensure that tied flexible connectors are used for all mechanical equipment mounted on inertia bases or anti-vibration mounts.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the rubber flexible connectors. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the rubber flexible connector specialist that his proposals are acceptable prior to ordering.

CORRUGATED STAINLESS STEEL BRAIDED FLEXIBLE CONNECTORS

The M.S.C. shall make due allowances for vibration of plant items and shall provide corrugated stainless steel braided flexible connectors as required.

These shall be as follows:-

Flexible connectors shall be provided with flanged or screwed ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

The types and model references are as follows:-

For steel pipework,

Flanged Braided Flexible Connectors shall be type **BBF** comprising a stainless steel convoluted hose and overbraiding with carbon steel flanges.

Screwed Braided Flexible Connectors shall be type **BBT** comprising a stainless steel convoluted hose and overbraiding with carbon steel threaded BSP ends.

For copper pipework,

Flanged Braided Flexible Connectors shall be type **BBFN** comprising a stainless steel convoluted hose and overbraiding with stainless steel van-stone ends and carbon steel backing flanges.

Screwed Braided Flexible Connectors shall be type **BBTN** comprising a stainless steel convoluted hose and overbraiding with stainless steel threaded BSP ends.

Copper-tailed Braided Flexible Connectors shall be type **BBC** comprising a stainless steel convoluted hose and overbraiding with copper tube ends.

Screwed and Copper-tailed Braided Flexible Connectors shall be supplied with Armaflex insulation (suffix **A**) when required, e.g. **BBTA**, **BBTNA** and **BBCA**.

Screwed and Copper-tailed Braided Flexible Connectors shall be supplied with a smooth plastic shrink-fit cover (suffix **P**) when required, e.g. **BBTP**, **BBTNP** and **BBCP**.

Screwed and Copper-tailed Braided Flexible Connectors shall be supplied with Armaflex insulation and a smooth plastic shrink-fit cover (suffix **AP**) when required, e.g. **BBTAP**, **BBTNAP** and **BBCAP**.

The maximum temperature for Braided Flexible Connectors with Armaflex insulation (suffix **A**) shall not exceed 105°C

The maximum temperature for Braided Flexible Connectors with shrink-fit cover (suffix **P**) shall not exceed 95°C

All braided flexible connectors shall be '**EMFLEX**' units by :-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that vibration of plant is accommodated the M.S.C. shall:-

- a) Connect to items of plant in such a way that no stress is placed on the plant or connector.
- b) Support service pipework independently so that no load is placed on the braided flexible connector.
- c) Install braided flexible connectors in full accordance with the manufacturer's recommendations and instructions.
- d) Install braided flexible connectors between items of identical diameter. No bushing or other reductions shall be made at the flexible connector positions.
- e) Ensure that the maximum movement of the braided flexible connectors does not exceed those stated in the '**EMFLEX**' catalogue.
- f) Ensure that the minimum bend radius as stated in the '**EMFLEX**' catalogue is not exceeded.
- g) Not use braided flexible connectors to absorb AXIAL compression or elongation.
- h) Not install copper tailed devices by soldering or brazing unless wet cloths are used to prevent damaging the attachment of the copper tube to the stainless steel hose.
- i) Not use flux containing chloride.

The Contractor shall note that **N Minikin & Sons** of Harrogate have been consulted in the selection of the corrugated stainless steel braided flexible connectors. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the braided flexible connector specialist that his proposals are acceptable prior to ordering.

STAINLESS STEEL EXPANSION & CONTRACTION JOINTS

The M.S.C shall make due allowance for expansion and contraction of the services and shall provide stainless steel expansion or contraction joints as required.

These shall be as follows:-

Expansion Joints shall be provided with flanged or screwed ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure. They shall be supplied with external protective sleeves as required. (Suffix **E**)

The types and model references areas follows :-

For steel pipework,

Flanged Axial Expansion Joints shall be type **BAF** comprising stainless steel bellows and inner sleeve with carbon steel flanges.

Screwed Axial Expansion Joints shall be type **BAT**, as above but with carbon steel male BSP taper ends.

Fully Articulated Expansion Joints shall be type **BLF** comprising two stainless steel bellows and inner sleeves with carbon steel intermediate pipe, flanges and tie rods.

Double Hinged Expansion Joints shall be type **BDHF** comprising two stainless steel bellows and inner sleeves with carbon steel intermediate pipe, flanges and hinges.

Angular Expansion Joints shall be type **BHF** comprising stainless steel bellows and inner sleeve with carbon steel flanges and hinges.

Gimbal Expansion Joints shall be type **BGF** comprising stainless steel bellows and inner sleeve with c. steel flanges, centre ring and hinges.

Flanged Braided Lateral Expansion Joints shall be type **BBF** comprising stainless steel convoluted hose and overbraiding with carbon steel flanges.

Screwed Braided Lateral Expansion Joints shall be type **BBT**, as above but with carbon steel male BSP taper ends.

For copper pipework,

Flanged Axial Expansion Joints shall be type **BAFN** comprising stainless steel bellows and inner sleeve with stainless steel van-stone ends and carbon steel backing flanges.

Screwed Axial Expansion Joints shall be type **BATN**, as above but with stainless steel male BSP taper ends.

Fully Articulated Expansion Joints shall be type **BLFN** comprising two stainless steel bellows and inner sleeves with stainless steel intermediate pipe and van-stone ends with carbon steel backing flanges and tie rods.

Double Hinged Expansion Joints shall be type **BDHFN** comprising two stainless steel bellows and inner sleeves with stainless steel intermediate pipe and van-stone ends with carbon steel backing flanges and hinges.

Angular Expansion Joints shall be type **BHFN** comprising stainless steel bellows and inner sleeve with stainless steel van-stone ends and carbon steel backing flanges and hinges.

Gimbal Expansion Joints shall be type **BGFN** comprising stainless steel bellows and inner sleeve with stainless steel van-stone ends with carbon steel backing flanges, centre ring and hinges.

Flanged Braided Lateral Expansion Joints shall be type **BBFN** comprising stainless steel convoluted hose and overbraiding with stainless steel van-stone ends and carbon steel backing flanges.

Screwed Braided Lateral Expansion Joints shall be type **BBTN**, as above but with stainless steel male BSP taper ends.

All expansion joints shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.

Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that expansion and contraction of the pipework is accommodated throughout the building, the M.S.C shall :-

a) Install pipework so that stress is kept below the maximum permissible design stress as given in the appropriate pipework standard.

b) Not use branch connections as anchor points.

c) Wherever possible, cater for expansion and contraction by the inherent natural flexibility of the service pipework.

d) Where the use of inherent natural flexibility is not practicable, supply, install and connect expansion joints into the pipework installation. The position of these devices shall be to the approval of the Engineer.

e) Submit to the Engineer for approval prior to installing, the exact location and working drawing details including magnitude and direction of thrusts of all expansion joints, guides, anchors and other associated equipment.

f) Connect to items of plant and equipment in such a way that no stress is placed on the equipment or its connections.

g) Install expansion joints in full accordance with the manufacturer's recommendations and instructions.

h) Install expansion joints with a cold pull (cold draw) equal to 50% of total expansion, except where expansion joints are supplied with cold pull already applied.

i) Apply cold pull (cold draw) by means of flanges secured to the ends of pipe to be pulled together with long high tensile steel bolts and nuts. A check with the design figure for correct gap plus allowance for gasket thickness shall be made before final pull is made. A change to standard bolting shall be made when the gap is closed.

j) Not apply cold pull (cold draw) until the anchor installations have been completed and approved by the Engineer.

k) Install guides on each side of axial expansion joints. The first primary guide shall be located within a distance of 4 pipe diameters or 300mm whichever is the less. The second primary guide shall be located within a distance of 14 pipe diameters from the first guide. Where axial expansion joints are positioned next to an anchor the maximum distance shall be 4 pipe diameters or 300mm whichever is the less. If N Minikin & Sons Ltd impose more stringent requirements then these shall be implemented.

l) Provide intermediate guides for the remainder of the pipework at an interval as advised by N Minikin & Sons Ltd.

m) Install guides for all other expansion joint types as advised by N. Minikin & Sons Ltd.

n) Ensure that guides are capable of withstanding a lateral force of at least 15% of the anchor force.

o) Ensure that the lateral movement of the pipeline permitted by the guide is no more than 2mm (+/-1mm) for pipes up to 100mm nominal size and 4mm (+/-2mm) for larger pipes, for the two primary guides next to the expansion joint. For intermediate guides the movement should be no more than 4mm (+/-2mm) and 8mm (+/-4mm) respectively.

p) Design, fabricate and install anchors on site. These shall be at the positions advised by N Minikin & Sons Ltd.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the design of the expansion systems. They have approved the system proposed in this Contract and any deviation from these principles shall be at the Contractors risk and expense. The Contractor shall seek the confirmation of the expansion joint specialist that his expansion proposals are acceptable prior to ordering.

BUILDING MOVEMENT JOINTS

The M.S.C. shall make due allowance for settlement or subsidence when the pipeline crosses a building movement line and shall provide stainless steel braided flexible connectors or stainless steel restrained bellows as required.

These shall be as follows:-

Braided flexible connectors shall be provided with flanged or screwed ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

Stainless steel restrained bellows shall be provided with flanged ends only. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

The types and model references are as follows:-

For steel pipework,

Flanged Braided Flexible Connectors shall be type **BBF** comprising a stainless steel convoluted hose and overbraiding with carbon steel flanges.

Screwed Braided Flexible Connectors shall be type **BBT** comprising a stainless steel convoluted hose and overbraiding with carbon steel threaded BSP ends.

Flanged stainless steel restrained bellows shall be type **BLF, BDHF, BHF** or **BGF** (Fully Articulated, Double Hinged, Angular or Gimbal).
(see full specification for stainless steel expansion & contraction joints for more details)

For copper pipework,

Flanged Braided Flexible Connectors shall be type **BBFN** comprising a stainless steel convoluted hose and overbraiding with stainless steel van-stone ends and carbon steel backing flanges.

Screwed Braided Flexible Connectors shall be type **BBTN** comprising a stainless steel convoluted hose and overbraiding with stainless steel threaded BSP ends.

Flanged stainless steel restrained bellows shall be type **BLFN, BDHFN, BHFN** or **BGFN** (Fully Articulated, Double Hinged, Angular or Gimbal).
(see full specification for stainless steel expansion & contraction joints for more details)

Generally,

Pressure Balanced Bellows Expansion Joints shall be type **BPB**

All braided flexible connectors and restrained bellows shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that building movement is accommodated throughout the building the M.S.C. shall:-

a) Install pipework so that stress is kept below the maximum permissible design stress as given in the appropriate pipework standard.

b) Install braided flexible connectors or restrained bellows in full accordance with the manufacturer's recommendations and instructions.

c) Install braided flexible connectors perpendicular to the movement.

d) Install fully articulated and double hinged restrained bellows perpendicular to the movement.

e) Install angular and gimbal in 2-pin or 3-pin configurations as advised by N.Minikin & Sons Ltd.

f) Ensure that the maximum movement of the braided flexible connectors or restrained bellows does not exceed those stated in the '**EMFLEX**' catalogue.

g) Install anchors and guides as advised by N.Minikin & Sons Ltd.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the braided flexible connectors and restrained bellows building movement joints. They have approved the units proposed in this Contract and any deviation shall be at the Contractors risk and expense. The Contractor shall seek the confirmation of the braided flexible connector specialist that his proposals are acceptable prior to ordering.

QUICK RELEASE COUPLINGS

The M.S.C. shall make due allowance for ease of connection & disconnection of equipment and shall provide quick release couplings as required.

These shall be as follows :-

Quick release couplings shall be provided with screwed ends. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure. They shall be suitable for carrying all fluids required to be carried.

The types and model references are as follows :-

For all liquids and gases,

Quick release couplings with ball and groove locking mechanism shall be type **BGC** comprising two halves, a male and a female, each complete with an automatic shut-off valve. Each end of the coupling shall terminate with a female BSP thread. Couplings can be supplied if required with a 'straight-through' or 'non-valved' configuration.

Quick release couplings with screw thread locking mechanism shall be type **STC** comprising two halves, a male and a female, each complete with an automatic shut-off valve. Each end of the coupling shall terminate with a female BSP thread. Couplings can be supplied if required with a 'straight-through' or 'non-valved' configuration.

Quick release couplings with cam action locking mechanism shall be type **CAC** comprising two halves, a male and a female, each complete with a 'straight-through' configuration. Each end of the coupling shall terminate with a female BSP thread.

Quick release couplings shall be designed for easy operation and shall connect/disconnect with minimal spillage (valved units only). They shall have minimal pressure drop.

All quick release couplings shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that connection/disconnection of equipment is made with ease throughout the building, the M.S.C. shall :-

- a) Use quick release couplings in conjunction with flexible connectors or hoses.
- b) Ensure that debris does not clog the automatic operation of internal valves by installing suitable strainers in the system.
- c) Install quick release couplings in full accordance with the manufacturer's recommendations and instructions.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the quick release couplings. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the quick release coupling specialist that his proposals are acceptable prior to ordering.

GAS & OIL INSTALLATION BRAIDED FLEXIBLE CONNECTORS

The M.S.C. shall make due allowance for misalignment and vibration of gas and oil fed equipment and shall provide braided flexible connectors as required.

These shall be as follows :-

Braided Flexible Connectors shall be provided with flanged or screwed ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

The types and model references are as follows :-

For natural gas, LP gas and fuel oil,

Flanged Braided Flexible Connectors shall be type **BBF** comprising a stainless steel hose and overbraiding with carbon steel flanges.

Screwed Braided Flexible Connectors shall be type **BBT** comprising a stainless steel hose and overbraiding with carbon steel threaded BSP ends.

For butane and propane,

Flanged Braided Flexible Connectors shall be type **BBFN** comprising a stainless steel hose and overbraiding with stainless steel van-stone ends and carbon steel backing flanges.

Screwed Braided Flexible Connectors shall be type **BBTN** comprising a stainless steel hose and overbraiding with carbon steel threaded BSP ends.

Braided Flexible Connectors shall be flame resistant.

Braided Flexible Connectors shall be to the approval of British Gas where appropriate.

All Braided Flexible Connectors shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that misalignment and vibration of gas fed equipment is accommodated throughout the building the M.S.C. shall :-

- a) Install braided flexible connectors in full accordance with the manufacturer's recommendation and instructions.
- b) Connect to equipment in such a way that no stress is placed on the equipment or connector.
- c) Support service pipework independently so that no load is placed on the connector.
- d) Install connectors in full accordance with the manufacturer's recommendations and instructions.
- e) Fit braided flexible connectors between items of identical diameter.
- f) Ensure that the maximum movement of the braided flexible connectors does not exceed those stated in the '**EMFLEX**' catalogue.
- g) Not use braided flexible connectors for carrying fuel oil that contains sulphuric acid.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the Braided Flexible Connectors for gas and oil installations. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the Braided Flexible Connector specialist that his proposals are acceptable prior to ordering.

CATERING EQUIPMENT CONNECTORS

The M.S.C. shall make due allowance for the facility of mobility and for ease of connection and disconnection of catering equipment and shall provide flexible connectors, quick release couplings and ball valves as required.

These shall be as follows :-

Flexible connectors, quick release couplings and ball valves shall be provided with screwed ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

The types and model references are as follows :-

For gas service,

Flexible connectors shall be type **CATG**, comprising a stainless steel convoluted hose with a carbon steel screwed male BSP taper thread one end and a quick release valved rotary coupling the other end. A smooth yellow plastic shrink fit cover shall be applied over the convoluted hose to permit easy cleaning. A restraining wire shall accompany the hose and coupling.

Ball valves shall be type **BBVG**, comprising a nickel plated brass body and seat retainer, PTFE seat and packing, chromium plated brass ball, brass stem and plastic coated steel lever that operates through a quarter turn. Each end of the valve shall terminate with a female BSP thread.

For hot and cold water service,

Flexible connectors shall be type **CATW**, comprising a stainless steel convoluted hose and overbraiding with stainless steel screwed male BSP taper threads each end. A smooth blue, red, green or white plastic shrink fit cover shall be applied over the braiding to permit easy cleaning and identification of the service.

Quick release couplings shall be type **CATQ**, comprising two stainless steel halves, a male and a female each complete with shut off valve. The internal valve mechanism shall be stainless steel and seals shall be nitrile. Each end of the coupling shall terminate with a female BSP thread. Quick release couplings may alternatively be of straight through configuration.

Ball valves shall be type **BBVW**, comprising a bronze body and seat retainer, PTFE seat and packing, DZR brass ball, DZR brass stem and plastic coated steel lever that operates through a quarter turn. Each end of the valve shall terminate with a female BSP thread.

Ball valves may alternatively be type **BBVS**, comprising a stainless steel body, stem and ball with PTFE seat. A plastic coated steel lever shall operate through a quarter turn. Each end of the coupling shall terminate with a female BSP thread.

Flexible connectors type **CATG** shall comply with BS669 Part 2, 1997 and shall be approved by British Gas.

Ball valves type **BBVG** shall be tested and certified by British Gas to the relevant requirements of BS5494, 1978.

Flexible connectors type **CATW** shall be manufactured from material grades approved by WRc for use with potable water.

Quick release couplings type **CATQ** shall be manufactured from material grades approved by WRc for use with potable water.

Ball valves type **BBVW** and **BBVS** shall be manufactured from material grades approved by WRc for use with potable water.

All flexible connectors, restraining wires, quick release couplings and ball valves shall be 'EMFLEX' units by:-

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Notwithstanding the foregoing, in order that mobility and connection / disconnection of equipment is made with ease, the MSC shall:-

- a) Install flexible connectors, quick release couplings and ball valves in full accordance with the manufacturer's recommendations and instructions.
- b) Ensure that the minimum bend radius as stated in the 'EMFLEX' catalogue is not exceeded.
- c) Ensure that the flexible connector is not stretched or twisted.
- d) Not install flexible connectors where contact can be made with equipment whose operating temperature exceeds 90 deg.C
- e) Not allow chloride, chlorine or chlorite contamination of the stainless steel hose wall.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the catering equipment connectors. They have approved the units proposed in this Contract and any deviation shall be at the Contractors risk and expense. The Contractor shall seek the confirmation of the catering equipment connector specialist that his proposals are acceptable prior to ordering.

FAN COIL, CHILLED CEILING & CHILLED BEAM CONNECTORS

The M.S.C. shall make due allowances for ease of connection & disconnection of equipment and shall provide flexible hose connections and self sealing quick release couplings as required.

These shall be as follows :-

Flexible hose connectors shall be provided with screwed ends or copper pipe ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

Quick release couplings shall be provided with screwed ends. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

The types and models references are as follows :-

For fancoil heating service,

Flexible hose connectors for use on steel pipework shall be type **FCH** comprising a stainless steel convoluted hose with stainless steel overbraiding complete with carbon steel end connections and shall be of fully welded construction. When used on copper pipework they shall be type **FCHN** as above but with stainless steel end connections.

For fancoil chilled water service,

Flexible hose connectors for use on steel pipework shall be type **FCHA** comprising a stainless steel hose with stainless steel overbraiding complete with carbon steel end connections and shall be of fully welded construction. Complete with 'Armaflex' Class '0' insulation with vapour seal and end protection caps. When used on copper pipework they shall be type **FCHNA** as above but with stainless steel end connections.

For fancoil heating and chilled water service,

Single body size quick release couplings shall be type **FCQ** comprising two nickel plated brass halves, a male and a female, each complete with a shut-off valve with a nitrile seal. The locking mechanism shall include 10 stainless steel balls of 4mm diameter for a secure and positive connection under pressure. Internal valve springs shall be stainless steel. Each end of the coupling shall terminate with a female BSP parallel connection with flat seat.

Full body size quick release couplings shall be type **FCQ-T** as above but with self colour brass body.

For chilled ceiling and chilled beam chilled water service,

Flexible hose connectors shall be type **CHH** comprising a stainless steel hose and overbraiding complete with copper tube end connections and shall be of fully welded/silver-soldered construction.

Flexible hose connectors and quick release couplings for fancoils shall be suitable for a maximum working temperature of 95 deg.C and a maximum working pressure of 16 bar.

Flexible hose connectors for chilled ceilings and beams shall be suitable for use with push-in fittings or for direct soldering. They shall be suitable for a maximum working pressure of 10 bar.

Quick release couplings shall be designed for easy one-handed operation and shall connect/disconnect under pressure with minimal spillage and also have a minimal pressure drop.

Single body size quick release couplings shall be suitable for connection to control valves that terminate in a male BSP parallel thread with flat face. They shall be capable of being installed side by side at the average control valve port centres of 40mm. Flat faces at the bottoms of the female ends shall enable a positive connection to be made by the use of synthetic washers.

All hoses and couplings shall be '**EMFLEX**' units by:-

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Notwithstanding the foregoing, in order that connection / disconnection of equipment is made with ease throughout the building and that misalignment and vibration of equipment is accommodated the M.S.C. shall :-

a) Use flexible hose connectors in conjunction with quick release couplings to reduce installation and downtime maintenance costs on ceiling, wall and underfloor mounted equipment.

b) Connect to items of plant in such a way that no stress is placed on the plant or connector.

c) Support service pipework independently so that no load is placed on the flexible hose connectors.

d) Install flexible hose connectors and quick release couplings in full accordance with the manufacturer's recommendations and instructions.

e) Ensure that the minimum static bend radius as stated in the '**EMFLEX**' catalogue is not exceeded.

f) Not use flexible hose connectors to accommodate thermal expansion of the pipework.

g) Ensure that the hose is not stretched or twisted.

h) Use only BSP parallel male threads with the single body size quick release couplings. Taper threads may be used with the full body size quick release couplings.

i) Not allow ammonia contamination of the brass coupling body.

j) Not allow chloride, chlorine or chlorite contamination of the stainless steel hose wall.

k) Install pipe strainers to ensure debris does not clog the quick release coupling during flushing out process.

l) Do not solder hoses in place unless wet cloths are used to prevent damaging the attachment of the copper tube to the stainless steel hose.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the fancoil, chilled ceiling and chilled beam connectors. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the fancoil connector specialist that his proposals are acceptable prior to ordering.

RUBBER EXPANSION & CONTRACTION JOINTS

The M.S.C. shall make due allowance for expansion and contraction of plastic pipework services and shall provide rubber expansion / contraction joints as required.

These shall be as follows :-

Rubber expansion joints shall be provided with flanged ends. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system test pressure.

The types and model references are as follows :-

Axial rubber expansion joints shall be type **BB Untied** comprising a single sphere of nylon fabric reinforced chlorobutyl rubber with wire reinforced collars and fitted with carbon steel flanges.

Single articulated rubber expansion joints shall be type **BB Tied** comprising a single sphere of nylon fabric reinforced chlorobutyl rubber with wire reinforced collars and fitted with carbon steel oval flanges with hemispherical tie bar assembly.

Angular or hinged rubber expansion joints shall be type **BB Angular** comprising a single sphere of nylon fabric reinforced chlorobutyl rubber with wire reinforced collars and fitted with carbon steel flanges with special hinge assembly.

Full face rubber flexible connectors shall be type **FF** comprising a single membrane of reinforced rubber finishing with a full face, behind which are carbon steel backing flanges. The rubber compound used shall be selected to suit the application. The flanges shall be untied or tied to suit the movement.

All rubber expansion joints shall be '**EMFLEX**' units by:-

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Notwithstanding the foregoing in order that expansion and contraction of the plastic pipework is accommodated throughout the building, the M.S.C. shall :-

- a) Install plastic pipework so that stress is kept below the maximum permissible design as detailed by the plastic pipework manufacturer.
- b) Not use branch connectors as anchor points.
- c) Ensure the anchor points are strong enough to resist pressure thrust (e.g. use a valve support plate).
- d) Wherever possible, cater for expansion and contraction by the inherent natural flexibility of the plastic pipework.
- e) Where the use of inherent natural flexibility is not practicable, supply, install and connect rubber expansion joints into the plastic pipework installation. The position of these devices shall be to the approval of the Engineer.
- f) Submit to the Engineer for approval prior to installing, the exact location and working drawing details including magnitude and direction of thrusts of all rubber expansion joints, guides, anchors and other associated equipment.
- g) Connect to items of plant and equipment in such a way that no stress is placed on the equipment or its connections.
- h) Install rubber expansion joints in full accordance with the manufacturer's recommendations and instructions.
- i) Install rubber expansion joints with cold pull (cold draw) equal to 50% of the total expansion.
- j) Not apply cold pull (cold draw) until the anchor installations have been completed and approved by the Engineer.
- k) Install guides on each side of rubber expansion joints. The first primary guide shall be located within a distance of 4 pipe diameters or 300mm whichever is the less. The second primary guide shall be located within a distance of 10 pipe diameters from the first guide. Where rubber expansion joints are positioned next to an anchor the maximum distance shall be 4 pipe diameters or 300mm whichever is the less. If N Minikin & Sons Ltd impose more stringent requirements then these shall be implemented.
- l) Intermediate guides shall be provided for the remainder of the pipework at an interval as advised by N Minikin & Sons Ltd.
- m) Ensure that guides are capable of withstanding a lateral force of at least 15% of the anchor force.
- n) Ensure that the lateral movement of the pipeline permitted by the guides is no more than 2mm for pipes up to 100mm NB and 4mm for larger pipes, for the two primary guides next to the rubber expansion joint. For intermediate guides the movement should be no more than 4mm and 8mm respectively.
- o) Ensure that the maximum movement of the rubber expansion joints does not exceed those stated in the '**EMFLEX**' catalogue.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the design of the expansion systems. They have approved the system proposed in this Contract and any deviation from those principles shall be at the Contractors risk and expense. The Contractor shall seek the confirmation of the rubber expansion joint specialist that his expansion proposals are acceptable prior to ordering.

EXHAUST EXPANSION JOINTS

The M.S.C. shall make due allowance for the expansion of exhaust lines and for vibration due to exhaust pulsation from engines and shall provide exhaust expansion joints as required.

These shall be as follows :-

Exhaust expansion joints shall be provided with flanged or weld ends as appropriate. They shall be manufactured from approved material appropriate to the duty and shall be designed to withstand the system temperature.

The types and model references are as follows :-

Single axial exhaust expansion joints shall be type **BAFX** comprising a stainless steel convoluted membrane with carbon steel flanges.

Double axial exhaust expansion joints shall be type **BDFX** comprising two stainless steel convoluted membranes with carbon steel intermediate pipe and flanges.

Fully articulated exhaust expansion joints shall be type **BLFX** comprising two stainless steel convoluted membranes with carbon steel intermediate pipe, hinge assembly and flanges.

Double hinged exhaust expansion joints shall be type **BDHFX** comprising two stainless steel convoluted membranes with carbon steel intermediate pipe, hinge assembly and flanges.

Angular exhaust expansion joints shall be type **BHFX** comprising a stainless steel convoluted membrane with carbon steel hinges and flanges.

Gimbal exhaust expansion joints shall be type **BGFX** comprising a stainless steel convoluted membrane with carbon steel hinges, centre ring and flanges.

Single articulated exhaust expansion joints shall be type **BFCX** comprising a stainless steel convoluted membrane with carbon steel tie rods and flanges.

Braided lateral exhaust expansion joints shall be type **BBFX** comprising a stainless steel convoluted hose and overbraiding with carbon steel flanges.

Exhaust expansion joints shall incorporate internal or external sleeves when required.

Exhaust expansion joints shall be designed to have a predicted fatigue life of not less than 2000 complete full stress cycles.

All exhaust expansion joints shall be '**EMFLEX**' units by:-

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Notwithstanding the foregoing, in order that expansion and vibration of exhaust lines is accommodated, the M.S.C. shall :-

a) Install pipework so that stress is kept below the maximum permissible design stress.

b) Wherever possible, cater for expansion by the inherent natural flexibility of the pipework.

c) Where the use of inherent natural flexibility is not practicable, supply, install and connect exhaust expansion into the pipework installation. The position of these devices shall be to the approval of the Engineer.

d) Submit to the Engineer for approval prior to installing, the exact location and working drawing details including magnitude and direction of thrusts of all exhaust expansion joints, guides, anchors and other associated equipment.

e) Connect to items of plant and equipment in such a way that no stress is placed on the equipment or its connections. Particular attention shall be paid to exhaust expansion joints on turbocharger outlets from engines due to the sensitive equipment to which they are connected.

f) Install exhaust expansion joints in full accordance with the manufacturer's recommendations and instructions.

g) Guides shall be installed to the requirements of the Engineer or N.Minikin & Sons Ltd.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the design of the exhaust expansion systems. They have approved the system proposed in this Contract and any deviation from these principles shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the exhaust bellows specialist that his proposals are acceptable prior to ordering.

TAILOR MADE INSULATION COVERS

The M.S.C. shall make due allowance for the thermal insulation of expansion joints and flexible connectors and shall provide tailor-made insulation covers as required.

These shall be as follows :-

Tailor-made insulation covers shall be manufactured from approved material appropriate to the installation.

The types and model references are as follows :-

Tailor-made insulation covers shall be type **TMC** comprising a silicone coated glass cloth cover with ceramic fibre in-fill, velcro securing straps and draw strings.

They shall have a temperature range from -30 to +260C

The cover material shall be fire resistant in accordance with BS476 and have class 'O' fire rating.

The cover material shall be resistant to oil and shall be water repellent for external use.

All tailor-made insulation covers shall be '**EMFLEX**' units by:-

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Notwithstanding the foregoing, in order that insulation of expansion joints and flexible connectors is accommodated the M.S.C. shall :-

a) Install insulation covers in full accordance with the manufacturers' recommendations and instructions.

b) If required, request that the manufacturer incorporates an eyelet in the cover for connection of any attachments to ensure that the cover is kept within the vicinity of the expansion joint or flexible connector when the cover is removed for any reason.

c) Supply and install insulation covers to act as a 'fireguard' for vulnerable rubber bellows / flexible connectors in the event of minor plantroom fires.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the tailor-made insulation covers. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the tailor-made insulation cover specialist that his proposals are acceptable prior to ordering.

FLEXIBLE DUCT CONNECTORS

The M.S.C. shall make due allowance for vibration and noise transmission within duct systems and between plant and ductwork and shall provide flexible duct connectors as required.

These shall be as follows :-

Flexible duct connectors shall be provided with backing flats or clamping bands. They shall be manufactured from approved material appropriate to the duty.

The types and model references are as follows :-

For cool and warm clean air services,

Flexible duct connectors shall be type **FDC** comprising a neoprene coated glasscloth flexible membrane complete with steel backing flats (for on site drilling) or clamping bands.

Stainless steel backing flats and clamping bands shall be stated if required.

The flexible duct connectors shall be resistant to flame and shall conform to BS476, parts 7 & 8, having a fire rating of 2 hours.

All flexible duct connectors shall be '**EMFLEX**' units by:-

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Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that vibration and noise transmission is accommodated the M.S.C. shall :-

- a) Install flexible duct connectors in full accordance with the manufacturers' recommendations and instructions.
- b) Connect to ductwork and plant items in such a way that no stress or load is placed on the duct connector.
- c) Ensure that any stated maximum movement of the flexible duct connectors are not exceeded.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the flexible duct connectors. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the flexible duct connector specialist that his proposals are acceptable prior to ordering.

PIPE GUIDES & PIPE SKIDS

The M.S.C. shall make due allowance for the guiding of pipework containing expansion joints, loops or natural direction changes and shall provide pipe guides and pipe skids as required.

These shall be as follows:-

Pipe guides and skids shall be provided for bolting or welding to the building structure or to suitable steel work. They shall be manufactured from approved material appropriate to the pipeline material.

The types and model references are as follows :-

For steel pipework according to BS1387,

Tubular pipe slide guides shall be type **TSG** comprising carbon steel tubular chassis with steel guide rods. (up to 100mm pipe)

Light duty pipe slide guides shall be type **PSGL** comprising a steel chassis with steel T-slide and low friction PTFE inserts.

Medium duty pipe slide guides shall be type **PSGM** comprising a steel chassis with steel V-slide and low friction PTFE inserts.

Heavy duty pipe slide guides shall be type **PSGH** comprising a steel chassis with steel W-slide and low friction PTFE inserts.

Light duty pipe skids shall be type **PSL** comprising a support plate with stainless steel surface and a steel T-slide and low friction PTFE inserts.

Medium duty pipe skids shall be type **PSM** comprising a support plate with stainless steel surface and a steel V-slide and low friction PTFE inserts.

Heavy duty pipe skids shall be type **PSH** comprising a support plate with stainless steel surface and a steel W-slide and low friction PTFE inserts.

Roller, chair and guide assemblies shall be type **RCG** for steel pipe.

Saddle guides shall be type **SGS** comprising a formed steel strap designed not to grip the pipe.

For copper pipework according to BS2871,

Tubular pipe slide guides shall be type **TSGN** comprising carbon steel tubular chassis with copper guide rods. (up to 108mm pipe)

Light duty pipe slide guides shall be type **PSGLN** comprising a steel chassis with steel T-slide and low friction PTFE inserts. Pipe clamps are lined for copper pipes.

Medium duty pipe slide guides shall be type **PSGMN** comprising a steel chassis with steel V-slide and low friction PTFE inserts. Pipe clamps are lined for copper pipes.

Heavy duty pipe slide guides shall be type **PSGHN** comprising a steel chassis with steel W-slide and low friction PTFE inserts. Pipe clamps are lined for copper pipes.

Light duty pipe skids shall be type **PSLN** comprising a support plate with stainless steel surface and a steel T-slide and low friction PTFE inserts. Pipe clamps are lined for copper pipes.

Medium duty pipe skids shall be type **PSMN** comprising a support plate with stainless steel surface and a steel V-slide and low friction PTFE inserts. Pipe clamps are lined for copper pipes.

Heavy duty pipe skids shall be type **PSHN** comprising a support plate with stainless steel surface and a steel W-slide and low friction PTFE inserts. Pipe clamps are lined for copper pipes.

Roller, chair and guide assemblies shall be type **RCGN** for copper pipe.

Saddle guides shall be type **SGC** comprising a nylon coated formed steel strap designed not to grip the pipe and polypropylene strip.

All pipe guides and skids shall be '**EMFLEX**' units by:-

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Notwithstanding the foregoing, in order that correct guiding of the expansion devices and the pipework is accommodated throughout the building, the M.S.C shall :-

a) Install pipe guides and skids in full accordance with the manufacturer's recommendations and instructions.

b) Install guides on each side of axial expansion joints. The first primary guide shall be located within a distance of 4 pipe diameters or 300mm whichever is the less. The second primary guide shall be located within a distance of 14 pipe diameters from the first guide.

c) Provide intermediate guides for the remainder of the pipework at an interval as advised by N Minikin & Sons Ltd.

d) Install guides for all other expansion joints types as advised by N.Minikin & Sons Ltd.

e) Ensure that guides and their fixings to the building structure are capable of withstanding a lateral force of at least 15% of the anchor force.

f) Ensure the lateral movement of the pipeline permitted by the guide is no more than 2mm for pipes up to 100mm NB and 4mm for larger pipes, for the two primary guides next to the expansion joint. For intermediate guides the movement should be no more than 4mm and 8mm respectively.

g) Ensure that all guides, skids and anchors are correctly fitted prior to testing.

h) Ensure that tubular guides are slid onto the pipeline before welding any flanges or branches as they can not be fitted later.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the pipe guides and pipe skids. They have approved the system proposed in this Contract and any deviation from these principles shall be at the Contractors risk and expense. The Contractor shall seek the confirmation of the tubular pipe slide guide specialist that his proposals are acceptable prior to ordering.

INERTIA BASES AND A.V. MOUNTS

The M.S.C. shall make due allowance for improvement of mechanical equipment stability and minimising vibratory movement and noise transmission due to mechanical equipment operation. Inertia bases and mounts shall be provided as required.

These shall be as follows :-

A package comprising a steel inertia pouring frame and anti-vibration mounts shall be provided. It shall be manufactured from approved materials and shall be correctly designed to suit the particular mechanical equipment.

The types and model references are as follows :-

Inertia base and mount package shall be type **IBMP** comprising welded steel base assembly with inbuilt steel reinforcing mesh and steel outrigger mounting brackets. (Inboard mounting brackets if required). A finish suitable for internal or external use shall be provided. Suitable mounts shall be provided.

All inertia base and mount packages shall be '**EMFLEX**' units by:-

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Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that correct mounting of equipment is accommodated throughout the building, the M.S.C. shall:-

- a) Install inertia bases and mounts in full accordance with the manufacturers' recommendations and instructions.
- b) Fill the base with concrete on site and shall liaise with the building contractor on the pouring of the concrete and subsequent lifting.
- c) Ensure that the surface of the concrete fill is steel float finished (or equivalent) and levelled to the mechanical equipment manufacturers' requirements.
- d) Fix mechanical equipment to the base in a manner acceptable to both the mechanical equipment manufacturer and to the Engineer.
- e) Ensure that all debris is removed from between the underside of the base and the floor prior to mechanical equipment start-up.
- f) Ensure that the inertia base is sufficiently large to provide support for all parts of the mechanical equipment, including any equipment which overhangs the equipment base.
- g) Provide N.Minikin & Sons Ltd with necessary details to enable them to make correct selection of the inertia base and mount package.
- h) Generally allow an individual inertia base for each piece of mechanical equipment. (e.g. mount run and standby pumps on two bases, not one base).

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the inertia base and mount package. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the inertia base and mount specialist that his proposals are acceptable prior to ordering.

PIPEWORK & EQUIPMENT A.V. HANGERS

The M.S.C. shall make due allowance for vibration transmission between pipework, ductwork or mechanical equipment and the building structure and shall provide A.V. hangers as required.

These shall be as follows :-

Hangers shall incorporate a steel hanger box with synthetic rubber isolating element and / or helical steel spring. They shall be manufactured from approved materials and shall suit the pipework or equipment being supported.

The types and model references are as follows :-

Spring hangers shall be type **HS** comprising a steel hanger box with helical steel spring.

Positioned spring hangers shall be type **HPS** comprising a steel hanger box and positioning plate with helical steel spring.

Spring and rubber hangers shall be type **HSR** comprising a steel hanger box with helical steel spring and neoprene rubber isolator.

Positioned spring and rubber hangers shall be type **HPSR** comprising a steel hanger box and positioning plate with helical steel spring and neoprene rubber isolator.

Neoprene rubber hangers shall be type **HNR** comprising a steel hanger box with neoprene rubber isolator.

All hangers shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that vibration transmission is accommodated throughout the building, the M.S.C. shall :-

- a) Install hangers in full accordance with the manufacturer's recommendations and instructions.
- b) Ensure that, where both rubber and spring isolating elements are used together, the spring shall be at the pipework, ductwork or equipment end of the hanger box.
- c) Ensure that both rubber and spring isolating elements are used in compression only.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the pipework and equipment hangers. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The Contractor shall seek the confirmation of the hanger specialist that his proposals are acceptable prior to ordering.

ANTI VIBRATION MOUNTS

The M.S.C. shall make due allowance for vibration transmission between equipment and the building structure and shall provide anti vibration mounts as required.

These shall be as follows:-

Mounts shall incorporate suitable base plate with rubber turret or helical steel spring and steel fixing/levelling bolt. They shall be manufactured from approved materials and shall suit the equipment being supported.

The types and model references are as follows:-

To suit the equipment or plant being supported,

Open spring mounts shall be type **MOS** comprising a steel base plate with helical steel spring, steel top cap and steel fixing/levelling bolt.

Closed spring mounts shall be type **MCS** comprising a steel base plate and enclosure with helical steel spring, steel top cap and steel fixing/levelling bolt.

Restrained spring mounts shall be type **MROS** comprising a steel base plate and restraint housing with helical steel spring and steel fixing/levelling bolt.

Heavy duty restrained spring mounts shall be type **MROS-HD** comprising a steel base plate, heavy duty steel channel restraints and steel load plate with helical steel spring and steel fixing bolt.

Neoprene rubber mounts shall be type **MNR** comprising a neoprene rubber turret with base plate and steel fixing/levelling bolt.

Rubber and cork isolation pads shall be type **NCN** comprising a cork central layer laminated between two neoprene rubber pads.

Rubber ribbed pads shall be type **NRP** comprising a neoprene rubber pad with moulded rubber ribs.

All anti-vibration mounts shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.

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Notwithstanding the foregoing, in order that vibration transmission is accommodated throughout the building, the M.S.C. shall:-

a) Install anti vibration mounts, in full accordance with the manufacturer's recommendations and instructions.

b) Ensure that both rubber and spring isolating elements are used in compression only.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the anti-vibration mounts. They have approved the units proposed in this Contract and any deviation shall be at the Contractors risk and expense. The contractor shall seek the confirmation of the anti vibration mount specialist that his proposals are acceptable prior to ordering.

AIR & DIRT SEPARATORS

The M.S.C. shall make due allowance for removal of air and dirt from the system pipework and shall provide air and dirt separators as required.

These shall be as follows:-

Air and Dirt Separators shall incorporate a suitable vessel with appropriate baffles to facilitate air and dirt removal. They shall be manufactured from approved materials and shall suit the system flow rates and removal efficiency required.

The types and model references are as follows:-

For standard flow rates,

Centrifugal Air Separators shall be type **SCAF** with flanged ends or type **SCAW** with weld ends, and shall comprise a steel shell with off-set inlet and outlet ports, and top mounted automatic air vent.

Microbubble Air Separators shall be type **SMAF** with flanged ends, type **SMAT** with threaded ends, or type **SMAW** with weld ends, and shall comprise a steel shell with in-line inlet and outlet ports, and top mounted automatic air vent.

Microbubble Air and Dirt Separators shall be type **SMADF** with flanged ends or type **SMADW** with weld ends, and shall comprise a steel shell with in-line inlet and outlet ports, top mounted automatic air vent, and bottom mounted drain valve.

Dirt Separators shall be type **SDF** with flanged ends, and type **SDFI** with flanged ends and insulated enclosure, and shall comprise a steel shell with vertical inlet port, horizontal outlet port, top mounted automatic air vent, and bottom mounted drain valve.

For high flow rates, the model types above shall be suffixed **H**.

For ultra high flow rates, the model types above shall be suffixed **UH**.

All air and dirt separators shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that efficient air and dirt removal is accommodated throughout the building, the M.S.C. shall:-

- a) Install air and dirt separators, in full accordance with the manufacturer's recommendations and instructions.
- b) Ensure that maximum flow rates are not exceeded.
- c) Ensure that the microbubble units are used where the static head does not exceed 30 metres.
- d) Install centrifugal air separators at the suction side of a pump on the flow from the boiler.
- e) For heating installations, install microbubble air separators in the flow circuit immediately after the boiler.
- f) For cooling installations, install microbubble air separators in the flow circuit just before the coil.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the air and dirt separators. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The contractor shall seek the confirmation of the air and dirt separator specialist that his proposals are acceptable prior to ordering.

AUTOMATIC AIR VENTS

The M.S.C. shall make due allowance for the automatic removal of air from high points in the system pipework and shall provide automatic air vents as required.

These shall be as follows:-

Automatic air vents shall incorporate a conical air chamber with float and venting valve. They shall be manufactured from approved materials and shall be designed so that damage from the outside is almost impossible.

The types and model references are as follows:-

Automatic Air Vents shall be type **SAAV-S** with 1/2" BSP female threaded connection, and shall comprise a brass body incorporating a conical air chamber and air venting valve. An optional shut-off valve is available.

All automatic air vents shall be '**EMFLEX**' units by:-

N Minikin & Sons Ltd of Harrogate.
Tel:01423 889845 Fax:01423 880724 Email:minikin@dial.pipex.com

Notwithstanding the foregoing, in order that efficient automatic air removal is accommodated throughout the building, the M.S.C. shall:-

- a) Install automatic air vents in full accordance with the manufacturer's recommendations and instructions.
- b) Ensure that maximum working pressure of 10bar is not exceeded.
- c) Ensure that they are mounted in a vertical position where air is collected naturally in the system.

The Contractor shall note that **N Minikin & Sons Ltd** of Harrogate have been consulted in the selection of the automatic air vents. They have approved the units proposed in this Contract and any deviation shall be at the Contractor's risk and expense. The contractor shall seek the confirmation of the automatic air vent specialist that his proposals are acceptable prior to ordering.

N.MINIKIN AND SONS LIMITED CONDITIONS OF BUSINESS

1.00

The following conditions ("the Conditions") apply to and are deemed to be incorporated in all contracts for the sale of Goods by N. Minikin & Sons Limited ("the Company") to the buyer and the provision of advice or other services ("Services") by Salesmen or Engineers employed by the Company either during telephone negotiations or site or office visits and the Buyer acknowledges that these Conditions exclusively define the relationship and agreement between the Company and Buyer and that they supersede all other agreements and conditions between the parties. No variation in these Conditions, expressed or implied, shall be accepted by the Company unless expressly agreed in writing and signed by a director of the Company and signed on behalf of the Buyer

2.00

To the extent that these Conditions limit or exclude the liability of the Company to the Buyer or any person claiming through or under the buyer such limitation or exclusion of liability is imposed to avoid the need for the Company to increase the level of its insurance against the risks so limited or excluded, and thereby to minimise the cost to the Buyer of the Goods or Services supplied. If the Buyer nevertheless wishes the Company to be responsible for risks, or liability which is otherwise limited or excluded by these Conditions, then the Company will, at its option, quote an alternative price for the supply of the Goods or Services to reflect the additional cost of obtaining the appropriate additional insurance or other appropriate cover

3.00

All orders for the Goods made by the Buyer, orally or by telephone, shall be confirmed to the Company by the Buyer, in writing (including telex or fax) within 48 hours of being received by the Company whereupon a binding contract for the purchase by the Buyer of the Goods comprised in the order upon these Conditions shall be concluded. Any order made by the Buyer is subject to acceptance by the Company and a Contract will only be formed when the Company has accepted the Buyer's offer to buy

4.00

CANCELLATION AND RETURNS

4.01

No cancellation by the Buyer is permitted except where previously agreed in writing by a Director of the Company

4.02

The Buyer will in the event of cancellation by the Buyer not previously agreed as aforesaid indemnify the company fully against all expenses incurred up to the time of such cancellation together with by way of liquidated damages a sum of 50% of the contract price such sum being intended to represent a genuine pre-estimate by the Company and the Buyer of the loss (apart from the said expenses) suffered by the Company by reason of such cancellation and which shall be paid by the Buyer to the Company forthwith on cancellation

4.03

Goods supplied cannot be returned for credit without the previous approval in writing of the Company. A minimum handling charge of 30% will be made on the value of the Goods returned together with all carriage charges shall be paid by the Buyer. Specially manufactured items cannot be returned after delivery and orders for such items cannot be cancelled

5.00

DELIVERY

5.01

The Buyer shall accept delivery by the Company or its agents on the date, or within the time period stipulated by the Company. However, any time or period for delivery stipulated by the Company shall be deemed an estimate only and the Company shall not be liable in any way for the costs and consequences of any delay except where the parties agree otherwise in writing

5.02

The Company may make and the Buyer shall accept deliveries of the Goods comprised in any order by instalments

5.03

Delivery will be made by or on behalf of the Company to anywhere within the United Kingdom specified by the Buyer. Delivery to the Buyer's carrier or agent shall be deemed to be delivery to the buyer for the purpose of these Conditions of Business

6.00

TERMS OF PAYMENT

6.01

Unless otherwise expressly agreed in writing in accordance with Condition 1 payment for the Goods or Services will be made within 30 days after the end of the month in which the Goods or Services in question are delivered or rendered to the Buyer (except for any of the Goods in respect of which a claim has been made by the Buyer in accordance with Condition 12.00 hereof) No discount or allowance shall be made (unless otherwise agreed). Interest on any overdue account may be charged on a day to day basis, with monthly rests, at a rate of 4% above the base lending rate of National Westminster Bank Plc from time to time, whether before or after judgement

6.02

Value Added Tax at the rate from time to time ruling shall be added to the price and shall form part of the purchase price of the Goods or Services for the purpose of these Conditions

7.00

If the Buyer fails to make payment in accordance with Condition 6.00 the Company reserves the right to discontinue, defer or suspend the supply to the buyer of any other of the Goods or Services contracted to be supplied and the Company shall be entitled to claim against the Buyer for any loss or damage whatsoever sustained by it in consequence thereof

8.00

If the Buyer shall be unable or unwilling for any reason to take delivery of the Goods or Services on the specified date or within the specified period, delivery shall for the purposes of calculating time for payment in accordance with Condition 6.00 be deemed to have taken place 14 days after the said date or period. The Company reserves the right to charge the Buyer for the cost of storage, labour, insurance and transport if the Buyer shall be unable or unwilling to take delivery of the Goods or Services as aforesaid

9.00

PRICE

9.01

The Goods or Services will be sold to the Buyer at the prices agreed at time of order placed by the Buyer. The Company reserves the right to increase prices specified in the price list issued by the Company without notice to take account of any change in cost of wages, materials, insurance, transport, duty, tax, surcharge or levy of any kind

9.02

Any price quoted by the Company or contained in any order or contract shall be valid only for 28 days from the date of such quotation, order or contract

9.03

Carriage by the Company's normal transport in Great Britain is paid on orders over £750 value. Delivery of export orders will be F.O.B. the relevant United Kingdom port. Special packing or special delivery requirements will be charged extra

9.04

The Company shall not be liable for any loss whatsoever or howsoever arising caused by its non-delivery or by the failure to make Goods available ready for collection on the due date

10.00

PROPERTY OF THE GOODS

10.01

Notwithstanding risk in the Goods passes to the Buyer as soon as the Goods become ascertained Goods and subject as provided below, the Goods shall remain the sole and absolute property of the Company and title to and legal and equitable ownership of the Goods shall not pass to the Buyer until payment is received by the Company for all monies due from the buyer to the Company in respect of all Goods supplied by the Company to the Buyer and the buyer acknowledges that until such payment is made in full it is in possession of the Goods solely as a fiduciary for the Company

10.02

If Goods the property of the Company are admixed with Goods being the property of the Buyer or are processed or incorporated therein the product thereof will become or deemed to be the sole and exclusive property of the Company

10.03

If Goods the property of the Company are admixed with Goods the property of any person other than the Buyer or are processed or incorporated therein the product thereof shall become or deemed to be owned in common with that other person in proportion to the respective invoice values of the Goods comprised in such product

10.04

The Buyer is licensed by the Company to use or to agree to sell the Goods provided that the entire proceeds of sale of such Goods (or if such Goods have been converted into some other product or mixed with other Goods being the property of some person other than the Buyer a fair proportion of the proceeds of sale) are held in trust for the Company are not mixed with other monies or paid into an overdrawn bank account and shall at all times be identifiable as the Company's money

10.05

Until title to the Goods passes to the buyer the Goods shall be kept separate and distinct from all other property of the Buyer and of third parties and in good condition and stored in such a way as to be clearly identifiable as belonging to the Company and the buyer will not cause or permit or suffer any labels, badges, serial numbers, packaging or other means of identification of the Goods to be removed or obscured

10.06

Without prejudice to any other right or remedies available to it the Company may for the purpose of recovering its Goods and at any time before payment to it of all monies due from the Buyer enter upon any premises where such goods are stored or where they are reasonably thought to be stored and may re possess the same

10.07

If the Buyer being an individual commits any act of bankruptcy or enters into or takes steps to enter into an individual voluntary arrangement under the Insolvency Act 1986 or being a company enters into liquidation (whether compulsory or voluntary) or has a receiver appointed over the whole or any part of its assets or is the subject of an administration order or any person becomes entitled to exercise the powers conferred on an administrative receiver and any payment due from the Buyer to the Company is overdue in whole or in part or the Buyer is unable to meet its obligations as and when they fall due then the Company may (without prejudice to any of its other rights) recover or re-sell the Goods or any of them and may enter upon the Buyer's premises by its servants or agents, for that purpose

11.00

11.01 Where the Goods are ordered by reference to any sample the Company shall use its best endeavours to ensure that the bulk corresponds with the sample

11.02

The Company warrants that the Goods supplied or Services given to the Buyer will be suitable for the primary purpose for which the Goods and Services given is/are made and normally used. Subject thereto no warranty is given or to be implied as to the suitability of the Goods or Services given for any particular purpose or for use under any specific conditions unless such purpose or conditions have been previously agreed in writing by the Company

11.03

In connection with the supply of the Goods the Company warrants to the Buyer in the terms implied by Section 12 of the Sale of Goods Act 1979 as to title, quiet possession and freedom from encumbrances of the Goods but except as aforesaid and without prejudice to the generality of paragraphs 12.01 and 12.02 of these Conditions, the Company gives no warranty whether expressed or implied, by law or otherwise as regards the Goods supplied by it provided that in the event of the Company's negligence nothing herein shall limit or exclude the Company's liability for personal injury or death

11.04

Subject to the operation of any other specific provisions of these Conditions the Buyer's remedies against the Company in respect of any liability of the Company, whether in contract or in tort, shall not exceed the sum of £50,000 or the invoice value of the Goods directly giving rise to the claim or loss (whichever is less) for the Buyer's direct financial loss and any indirect or consequential loss (including loss of profit) suffered by the Buyer or for any claim made against the Buyer by a third party

Subject to the provisions of paragraph 11.00:-

12.01

All claims for loss caused by damage in transit, in storage or on delivery by the Company must be notified in writing by the Buyer to the Company within three days after receipt of the Goods and must within seven days thereafter be supported by a detailed written claim by the Buyer to the Company

12.02

All claims for non delivery, shortages, variances in design, or incorrect specification must be notified to the Company by the Buyer verbally or by telephone, telex, or fax no later than three days after the date of delivery in the case of claims for variances in design or incorrect specification and no later than 48 hours after the date for delivery in the case of claims for non delivery and shortages and in all such cases confirmed in writing no later than seven days after the date of delivery and it is expressly provided that no claims for shortages, variances in design or incorrect specification shall be accepted in whole or in part if the Goods in question have been installed or cut or worked-upon by the Buyer or its employees or agents

12.03

The risk of accidental loss whilst the Goods are being returned will be borne by the Buyer

12.04

Time shall be of the essence in respect of any notification to be given by the Buyer to the Company in accordance with this paragraph 12

13.00

Any failure on the part of the Company to exercise, or any delay by the Company in exercising, any right or remedy available to it, whether contained in these Conditions or otherwise, shall not operate as a waiver of such right nor shall any single or partial exercise by the Company of such right or remedy preclude the exercise, successively or concurrently of any right or remedy. Subject to the provisions of Condition 1, no waiver by the Company, whether as a part of the course of dealings between the Company and the Buyer, or otherwise of any time limit specified in these Conditions shall be effective

14.00

The Company shall not be liable or deemed to be in default for any delay or failure to perform its obligations under these Conditions if such delay or failure results directly or indirectly from any cause beyond the reasonable control of the Company, including, but not limited to, acts or restraints of government or governmental agencies, force majeure, act of God, war, riot, civil or criminal disturbance, insurrection, accidents, fire, explosion, earthquake, flood, the elements, strikes, labour disputes, shortages of suitable material, labour or transport

15.00

The Company shall be entitled forthwith to terminate any contract incorporating these Conditions and payment thereunder shall immediately become due if the Buyer shall make any default in or commit a breach of these Conditions or of any of its obligations to the Company or if any distress or execution shall be threatened or levied on the Buyer's property or assets, or if the Buyer shall make or offer to make any arrangement or composition with creditors or seek to obtain pursuant to statute or otherwise any moratorium with creditors or shall pass any resolution or shall suffer a petition to be presented for the winding-up of the Buyer (other than for the purpose of a solvent amalgamation or reconstruction notified to the Company) or if a receiver or manager of the Buyer's undertaking, property or assets or any part thereof shall be appointed without prejudice or any claim or right the Company might otherwise make or exercise

16.01

All contracts incorporating these Conditions shall be interpreted in accordance with the laws of England and shall be enforceable in the English Courts

16.02

Any contract incorporating these Conditions may not be assigned by the Buyer without the prior written consent of the Company

16.03

The obligations of the Company may be performed in whole or in part by its authorised distributors sub-contractors or agents at the discretion of the Company

16.04

In making these Conditions the Company does so for itself and for and on behalf of every employee servant sub-contractor or agent of the Company and the Buyer hereby confirms that any exemption from liability granted to the Company by these Conditions shall also extend to any such employee servant sub-contractor or agent of the Company

16.05

Any notice sent under a contract incorporating these Conditions shall be sent to the registered office of the Company or the Buyer (as the case may be) and shall be deemed duly given by letter 48 hours after being posted by pre-paid registered post or if delivered by hand at the time of delivery or if given by telex or fax when the sender shall receive the answerback of the recipient sent

ALSO AVAILABLE TO THE SPECIFIER

- * **Technical Advice**
- * **CIBSE Recognised CPD Courses**
- * **Slide Rule: Expansion Joint Calculator**
- * **Product Catalogue - Flexible Connectors, Expansion Joints & Related Equipment**
 - * **Anti Vibration Booklet**
 - * **Technical Reports**
- * **Design Book: "The Application of Expansion Joints to Pipework Systems"**
 - * **Pipe Guides and Skids**
 - * **Installation Instructions**
- * **Quality Assurance to BS EN ISO 9002**

Minikin is a Patron of the
Chartered Institution of
Building Services Engineers

N. Minikin & Sons Ltd

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