

## Stage 3 : DEVELOPED DESIGN

### RIBA summary of Stage 3

“During this stage, the Concept Design is further developed and, crucially, the design work of the core designers is progressed until the spatial coordination exercises have been completed between the main design disciplines. This process may require a number of iterations of the design and different tools may be used, including design workshops.

By the end of Stage 3, the architectural, building services and structural engineering designs will all have been developed, and will have been checked by the lead designer, with the stage design coordinated between disciplines and the Cost Information aligned to the Project Budget.

Project Strategies that were prepared during Stage 2 should be developed further and in sufficient detail to allow the client to sign them off once the lead designer has checked each strategy and verified that the Cost Information incorporates adequate allowances.

Change Control Procedures should be implemented to ensure that any changes to the Concept Design are properly considered and signed off, regardless of how they are instigated.

While specialist subcontractors will undertake their design work at Stage 4, they may provide information and guidance at Stage 3 in order to facilitate a more robust developed design.”

### BSRIA summary of proforma 3

Proforma 3 covers the Developed Design stage. This is a collaborative design stage where any remaining concepts from Stage 2 are decided. In the absence of an alternative project strategy, this stage also covers the development of the design to the stage where a planning application can be submitted, with emphasis on external matters rather than internal coordination. By the end of this stage, the design team has arrived at a design where main plant and main services distribution have been sized using approximate methods and each discipline has its allocated volumes within the building. From a building services perspective, there is sufficient evidence to show that the services volume is sufficient to contain the building services and it is consistent with all project strategies. Services treatments in rooms and spaces are scheduled in performance terms.

PROFORMA 3: DEVELOPED DESIGN (RIBA STAGE 3)								
Ref	Design activity in connection with building services	Allocated to .... L=Lead, S=Support, R=Review						Comments
		A	B	C	D	E	Z	
	<b>General obligations, external liaison (statutory bodies, utilities)</b>							
3.1.1	Carry out ongoing checks for compliance with regulations.							
3.1.2	Negotiate with public and other utility authorities for the provision of incoming services and agree spatial requirements.							Where applicable this will also include liaison with services providers for low and zero carbon technologies to review interface issues and ensure design compatibility
3.1.3	Consider services design to allow off-site manufacture if appropriate.							
3.1.4	Identify interfaces between on-site and off-site elements and define packages of work to deliver off-site strategy.							
3.1.5	Monitor compliance of the developing design with the design philosophies.							
3.1.6	Monitor compliance of the developing design with the project brief.							
3.1.7	Review strategy for fire safety (include parameters for fire detection and suppression systems, protection of building services).							
	<b>Client liaison (briefing, handover, surveys)</b>							
3.2.1	Prepare the building services Employers Information Requirements in accordance with PAS 1192-2.							State appointment this relates to
3.2.2	Prepare pre-contract BIM Execution Plan for building services Design and Build development (as required by procurement route).							As per PAS 1192-2
3.2.3	Confirm design criteria, scope and extent of mechanical, electrical and public health services.							
3.2.4	Update recommendations to the client in his development of an operating and maintenance strategy.							
	<b>Team liaison (builders' work, spatial coordination, energy targeting)</b>							
3.3.1	Review architectural and structural designs to identify existing or potential conflicts with indicative plant-room, plant and riser locations and sizes and in relation to building weight allowances.							
3.3.2	Advise on access routes and plant size and weight in relation to future plant removal and replacement.							
3.3.3	Review design risk assessments and update to reflect developing design.							Specify extent (e.g. H&S, technical, commercial)

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3.3.4	Review design against Building Regulations compliance in relation to energy performance and (if relevant) EPC criteria.							
3.3.5	Review dimensional and other numerical tolerances to be applied to building services design and deliverables at different project stages.							
3.3.6	Carry out calculations in relation to any energy-related planning conditions and advise team of implications to overall design.							
3.3.7	Incorporate frozen primary building geometry in building services design.							
3.3.8	Approve and share primary building geometry (General Arrangement drawings or building information model).							
3.3.9	Obtain room data.							
3.3.10	Populate room data with building services information.							
3.3.11	Review specialist design inputs and incorporate into building services proposals.							Specify extent (e.g. fire, acoustic)
3.3.12	Develop and update BIM Execution Plan during project.							As per PAS 1192-2
3.3.13	Develop and update building services Task Information Delivery Plan for Design and Build development.							
3.3.14	Develop and update Master Information Delivery Plan during project.							As per PAS 1192-2
3.3.15	Federate information models from separate task teams and oversee the clash avoidance process.							As per PAS 1192-2. See also 2.3.14
3.3.16	Carry out Stage 3 coordination.							
3.3.17	Remove critical clashes from the building services developed design.							See section 2.5 of BG 6
3.3.18	Review BIM protocol and determine data fields to be completed for each BIM object.							
3.3.19	Team-wide design review to signal end of developed design stage.							See section 3.8 of BG 6
	<b>Selection of plant and specialist designers</b>							
3.4.1	Prepare Developed Design for specialist design items not included in 3.5.2, 3.6.2, 3.7.2.							Specify items (e.g. long lead time, critical path or technically critical items) and agree extent of developed design

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	<b>Mechanical design</b>							
3.5.1	Propose primary design criteria and extent of mechanical systems.							
3.5.2	Develop preliminary information on specialist mechanical systems to be procured as Contractor Design Portions, such as performance specification, loads, schedules.						Systems may include ground heat source, grey water, fire suppression, specialist extract	
3.5.3	Prepare principal metering strategy.							
3.5.4	Establish indicative plant sizes for mechanical systems and confirm plant room/riser locations/sizes.							
3.5.5	Undertake dynamic thermal simulation studies in the development of energy strategies for the fabric and engineering services as required to support the design and obtain quantitative feedback – typically 3D modelling.						Scope to be defined	
3.5.6	Undertake computational fluid dynamics studies as part of a detailed evaluation for the particular stated aspects of the building services design.						State requirements e.g. air movement in specific areas, smoke clearance, effectiveness of air movement for natural ventilation	
3.5.7	Calculate zoned heat gains and losses based on fabric information, using approximate methods.							
3.5.8	Determine main duct and pipe routes around floors to and from risers.						Consider ability to install, commission and maintain	
3.5.9	Calculate room loads using approximate methods.							
3.5.10	Determine approximate duct sizes, pipe sizes, terminal sizes and locations, valve sizes and locations, fan sizes, pump sizes, locations and sizes of ancillary equipment (such as pressurisation units, and attenuators).						Sufficient for developed design i.e. spatial allocation and detailed schematics	
3.5.11	Design review.						See section 3.8 of BG 6	
	<b>Electrical design</b>							
3.6.1	Propose primary design criteria and extent of electrical systems.						Including renewable energy and back-up supply	
3.6.2	Develop preliminary information on specialist electrical systems to be procured as Contractor Design Portions, such as performance specification, loads, schedules.						Systems may include data, telephony, security	
3.6.3	Determine principal plant (equipment) locations/sizes.							
3.6.4	Prepare principal metering strategy.							

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3.6.5	Establish indicative plant sizes for electrical systems and confirm equipment/switch room and riser locations/sizes.							
3.6.6	Undertake daylight computer modelling required to support the design and obtain quantitative feedback.							State particular requirements for the project
3.6.7	Calculate the maximum demand for small power and lighting using approximate methods.							
3.6.8	Calculate the maximum demand for high voltage supply using approximate methods.							
3.6.9	Determine main distribution routes and circuits around floors to and from risers and main switchgear, and approximate sizes of containment and switchgear.							Consider ability to install, commission and maintain
3.6.10	Design review.							See section 3.8 of BG 6
	<b>Public health design</b>							
3.7.1	Propose primary design criteria and extent of public health systems.							
3.7.2	Develop preliminary information on specialist public health systems to be procured as Contractor Design Portions, such as performance specification, loads, schedules.							Systems may include syphonic drainage
3.7.3	Establish approximate overall flow rates to allow below-ground drainage design to be completed by others.							
3.7.4	Establish main below-ground drainage routes and manhole locations.							
3.7.5	Define the design interface between above-ground and below-ground drainage systems.							
3.7.6	Ensure storm water discharge strategy meets the requirements of the planning authorities to meet their SuDS aspirations and that discharge flow rate is in accordance with planning and statutory authority requirements.							
3.7.7	Prepare principal metering strategy.							
3.7.8	Establish indicative plant sizes for public health systems and confirm plant room and riser locations/sizes.							
3.7.9	Calculate maximum demand for water supply and waste removal using approximate methods.							
3.7.10	Calculate approximate system capacities for hot and cold water central plant (tanks, cylinders, and pumps).							
3.7.11	Determine main pipe and drain routes around floors to and from risers.							Consider ability to install, commission and maintain
3.7.12	Design review.							See section 3.8 of BG 6

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	<b>Commissioning</b>							
3.8.1	Carry out commissioning review of developed design.							
3.8.2	Determine witnessing and commissioning requirements for off-site manufactured items.							
3.8.3	Update the commissioning plan.							
3.8.4	Appoint an independent specialist commissioning contractor responsible for testing and commissioning.						See also 4.8.8	
	<b>Deliverables – including drawings, specifications, reports</b>							
3.9.1	Provide energy statement for planning submission, based on agreed energy strategy.							
3.9.2	Provide performance information, specifications and/or main plant equipment schedules for mechanical, electrical and public health services if required by procurement strategy.							
3.9.3	Provide health and safety risk assessments for the developed design.							
3.9.4	Provide programme information on design and construction issues.							
3.9.5	Provide a report on building services developed design principles and issues as part of the developed design report. Specific considerations for this report include the items below. See BSRIA BG 71/2017 <i>Building Services Reports</i> for further details.							
3.9.5a	constraints arising from the brief, Local Authority policy or other external factors,							
3.9.5b	energy strategy and approach,							
3.9.5c	plant strategy,							
3.9.5d	principles of services distribution and requirements for services zones,							
3.9.5e	adequacy of utilities supplies and any particular requirements of utility authorities,							
3.9.5f	fire and smoke control strategy (including principles agreed with others e.g. architects and insurers),							
3.9.5g	construction methodology including off-site manufacture,							
3.9.5h	acoustic noise and vibration considerations related to building services equipment,							
3.9.5i	plant replacement strategy,							
3.9.5j	future-proofing considerations,							
3.9.5k	high-level metering strategy,							
3.9.5l	building Control requirements and any arising constraints,							
3.9.5m	limitations or considerations for future design development including any technical risks.							

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3.9.6	Provide developed design model.							
3.9.7	Provide developed design drawings.							
3.9.8	Provide developed schematics.							
3.9.9	Provide an initial schedule of cast-in/formed builders' work openings that are structurally significant.							
3.9.10	Provide updated schedule of builders' work requirements based on developed design.							
3.9.11	Provide estimate of regulated in-use energy consumption based on developed design.							
3.9.12	Provide information required in connection with any application for planning permission.							
3.9.13	Provide updated information for life-cycle assessment and/or through-life cost studies.							
3.9.14	Provide updated report on adequacy of existing mechanical, electrical and public health services to incorporate proposed extended or refurbished works.							Agree level of intrusion and physical testing if applicable
3.9.15	Provide design proposals to modify, refurbish or replace existing mechanical, electrical and public health services.							
3.9.16	Provide updated assessment of comfort conditions and overheating risk.							
3.9.17	Provide report on proposals or agreed outcomes following participation in any Soft Landings process.							
3.9.18	Provide a refined cost plan for building services (including quotations received).							
3.9.19	Provide report on any quotations received for equipment that needs to be selected at this stage to meet particular project requirements.							
3.9.20	Provide information to the Environmental Assessment Method Assessor to allow credits to be checked.							
3.9.21	Provide models or schedules of room data and building services treatments.							
3.9.22	Provide COBie tables for BIM Level 2 Information Exchange 3.							
3.9.23	Provide schedule of Contractor Design Portions using BG 6 Appendix B.							
3.9.24	Provide tender documentation for inclusion in a tender package if the procurement method requires it.							See also 2.9.6 and 4.9.9
3.9.25	Sign off the developed design report.							Usually by the client
	<b>Amended and additional activity descriptions</b>							
3.10.1	<insert text here>							

## Model definition: Developed Design model

### General definition

A model showing the extent of building services systems. The model should include the services treatments for each individual space:

- The type of system serving the space e.g. mechanical ventilation, cooling, etc.
- The system performance standards e.g. for lighting, heating, cooling, etc.
- The type and quantity of all other service elements within the space which are not defined in performance terms.
- Incorporate performance and spatial requirements for Contractor Design Portion (CDP) elements.

Approximate locations of horizontal and vertical services runs are shown and should convey maximum space requirements for expected plant and distribution systems, taking account of falls, coordination, tolerances, installation, maintenance and removal. The model could also indicate designs for repeatable areas (e.g. standard room types) to identify key principles.

Tolerances for developed design models should be agreed between the recipient and the author before developed design starts, with reference to other members of the project team as appropriate. Tolerances may be expressed in terms of absolute values, or percentage variance, in relation to volume, area, length, weight or some other property.

Objects are linked together into systems.

Analogous to detail in Developed Design drawings.

Typical object parameters to add to parameters from Stage 2 would include:

- Object name
- Object identifier (system, floor/zone/room)
- Location (adjacent grid references)
- Approximate size and weight.
- Key design criteria



**Example additional definition for mechanical services**

Principal ductwork (within risers and from risers to local plant) could be shown as 3D objects to demonstrate that the routes indicated are feasible. Ductwork from local plant to terminal units and pipework may be represented by centre-lines, but should also detail routes to & from secondary areas. Additional sections / elevations may also be needed to demonstrate the robustness of the design at this stage

**Example additional definition for electrical services**

Distribution boards should indicate numbers of ways & proposed loads. Electrical containment can be represented by centre-lines unless it is similar in size to principal ductwork, when 3D objects should be used. Lighting detail is typically at treatment level, but layouts can be provided in sensitive areas.

**Example additional definition for public health services**

Stack locations, float pipe locations and letterbox space allocations for pipe falls along drainage runs should be shown.

**Typical uses for the model at this stage:**

<b>Analysis</b>	The model may be analysed to determine the approximate nominal capacities of plant and distribution systems
<b>Costing</b>	The model may be used to develop cost estimates based on approximate quantities and approximate sizes of plan
<b>Programme</b>	The model may be used to show the timing of installation of the main building services systems.

### Drawing definition: Developed Design drawings

Drawings showing the extent of the services installations. The main features of Developed Design drawings should be as follows:

- plan layouts should be to a scale of at least 1:100 with key areas at 1:50.
- Show the extent and type of services terminals visible within the occupied space. Alternatively, these can be quantified and scheduled either as a tag on the drawing or as a separate schedule or room data sheet.
- Show approximate locations of horizontal and vertical service runs.
- Show main plant and main distribution system sizes, particularly those affecting spatial allocation, while acknowledging that these may need some adjustment and refinement in the preparation of the technical design drawings and equipment schedules.
- Pipework and electrical containment should be represented by single line layouts. Ductwork should be represented by either double line or single line layouts as required to demonstrate that the routes indicated are feasible (this should also be supplemented with key sections / elevations). Symbols and line conventions should be in accordance either with a recognised standard, such as ISO or BS, or a supplied legend.

These drawings will show how space within risers and service zones is allocated to:

- ductwork (using calculated, but still approximate, duct sizes)
- HVAC and domestic pipework (showing the number of pipes to be accommodated but only approximate diameters including insulation)
- electrical systems cable containment
- drainage (including extent of space required for falls).
- Building services related specialist services i.e. Fire / Acoustic

Where appropriate these drawings should indicate typical room/area details to show key principles of the systems within them or serving them.

**Drawing definition: Developed Design schematics**

Line diagrams describing the interconnection of components in a system showing the engineering principles. The main features of a Developed Design schematic drawing should be as follows:

- The drawings should include all the engineering components that make the system work, such as main plant, distribution, inline equipment supporting engineering performance, terminal plant providing HVAC performance. Quantities of performance-specified components would only be indicative at this stage, with accurate quantities on schedules or similar.
- Symbols and line conventions should be in accordance either with a recognised standard, such as ISO or BS, or a supplied legend.
- The drawings should be labelled with appropriate pipe, duct, busbar and cable sizes, pressures and flow rates. These details may be subject to adjustment during technical design and construction stages.
- The drawings should indicate components which have a sensing, control or measurement function.
- The major components indicated on the schematic drawing should be identified for cross-referencing purposes.

Where appropriate these drawings should indicate typical room/area details to show key principles of the systems within/serving them.

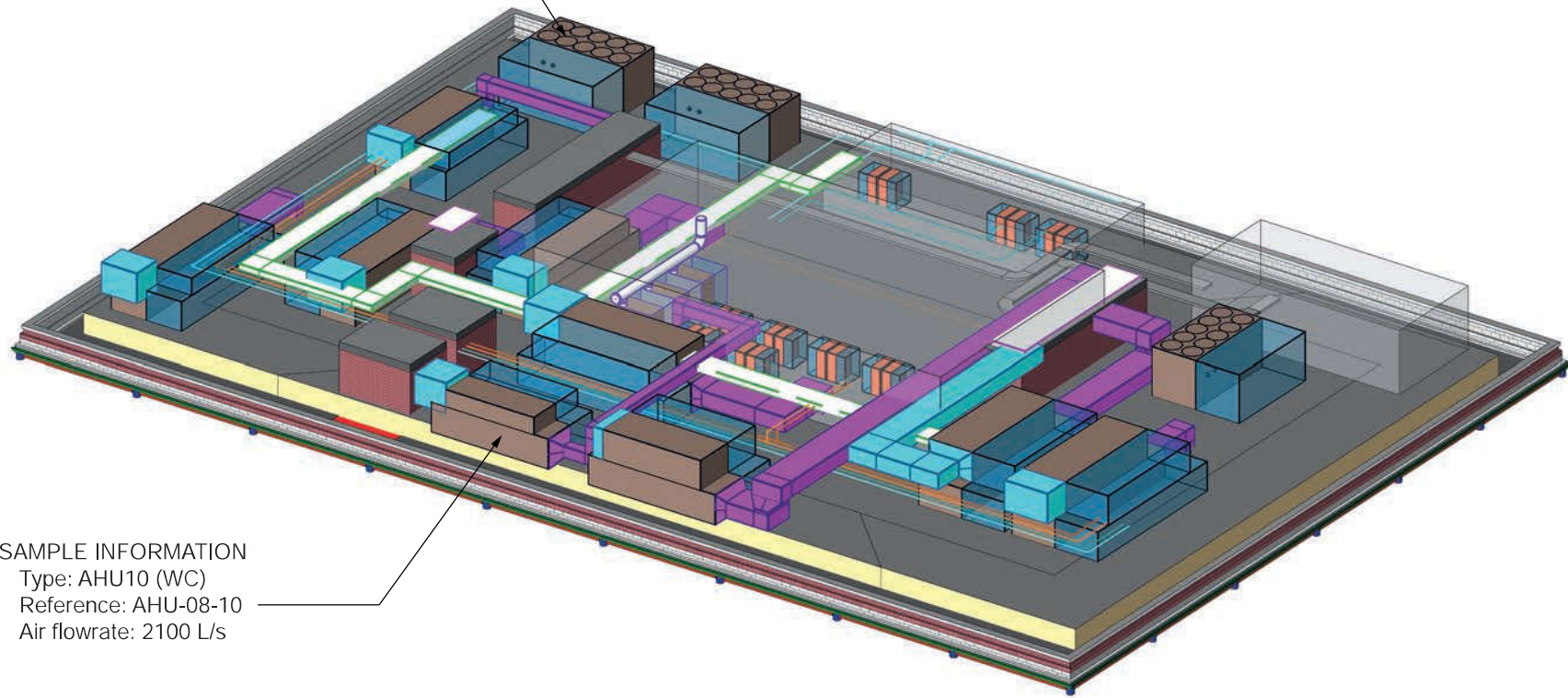
The *stage 3 Developed schematic fire alarm* would be similar to the *stage 2 concept schematic fire alarm*. Only minor additions would be made to reflect any changes to floors or areas covered.

SAMPLE INFORMATION

Type: Chiller  
Reference: CH-08-03  
Cooling duty: 400 kW

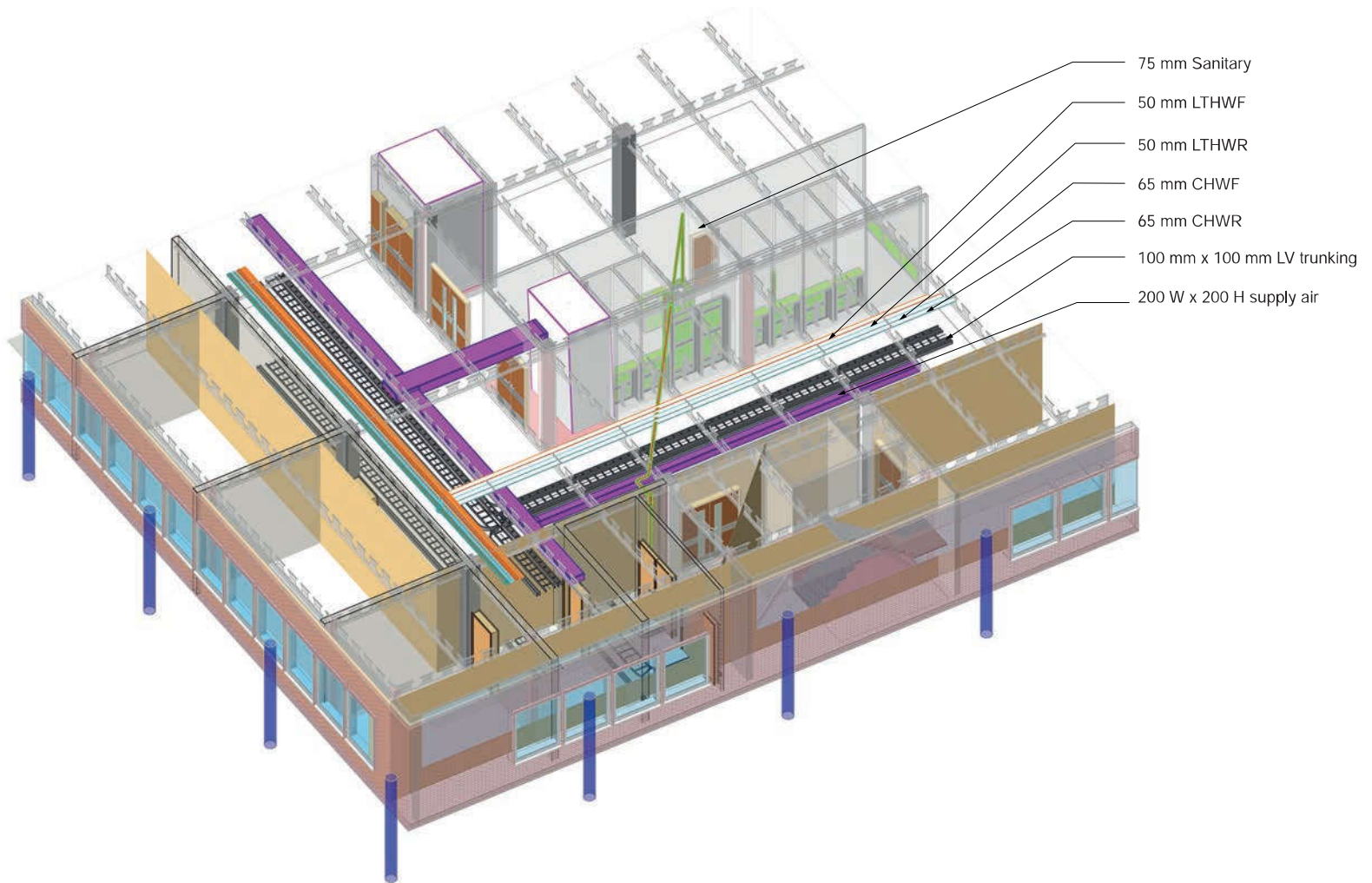
SAMPLE INFORMATION

Type: AHU10 (WC)  
Reference: AHU-08-10  
Air flowrate: 2100 L/s



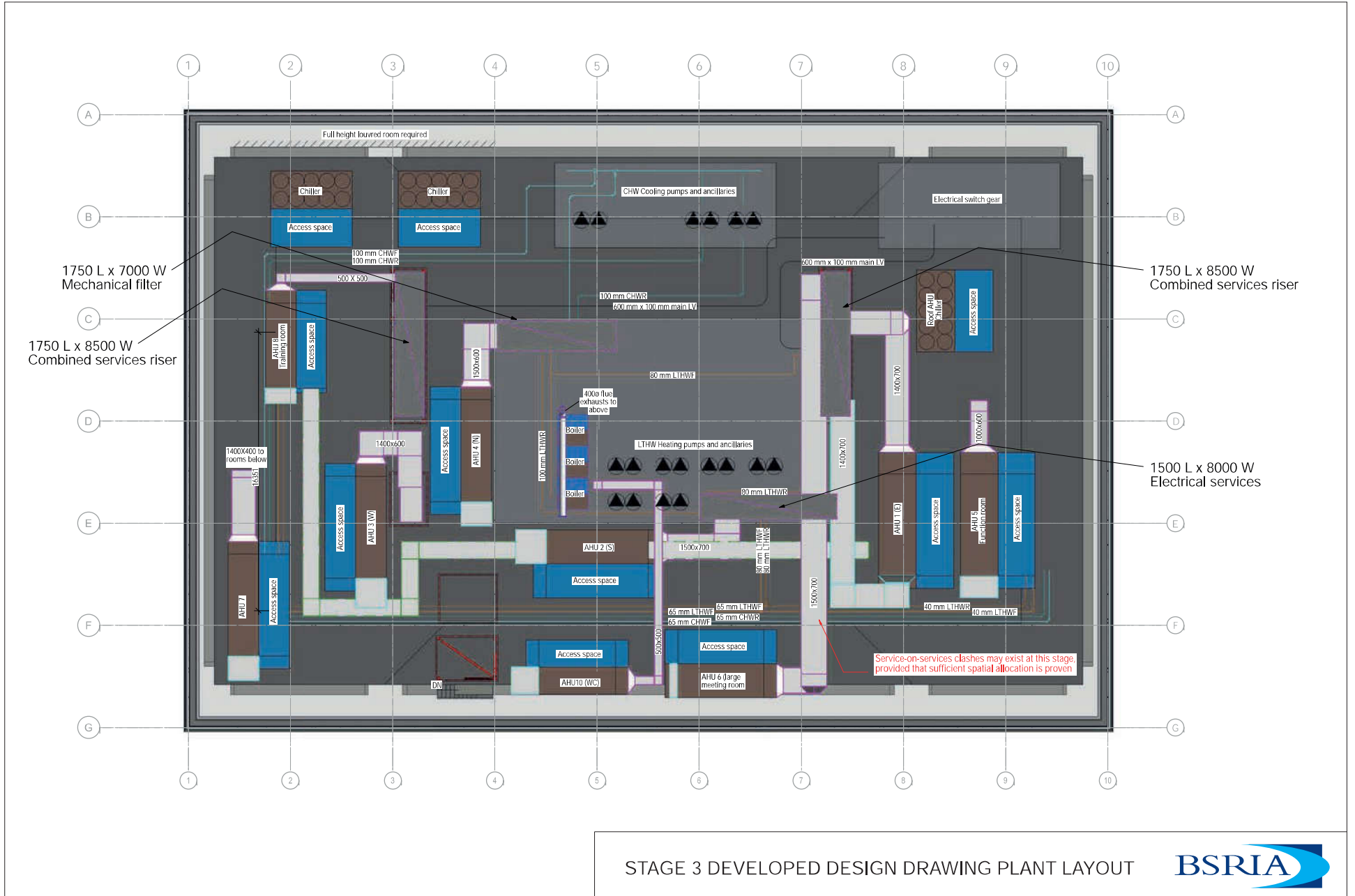
STAGE 3 DEVELOPED DESIGN MODEL PLANT 3D VIEW

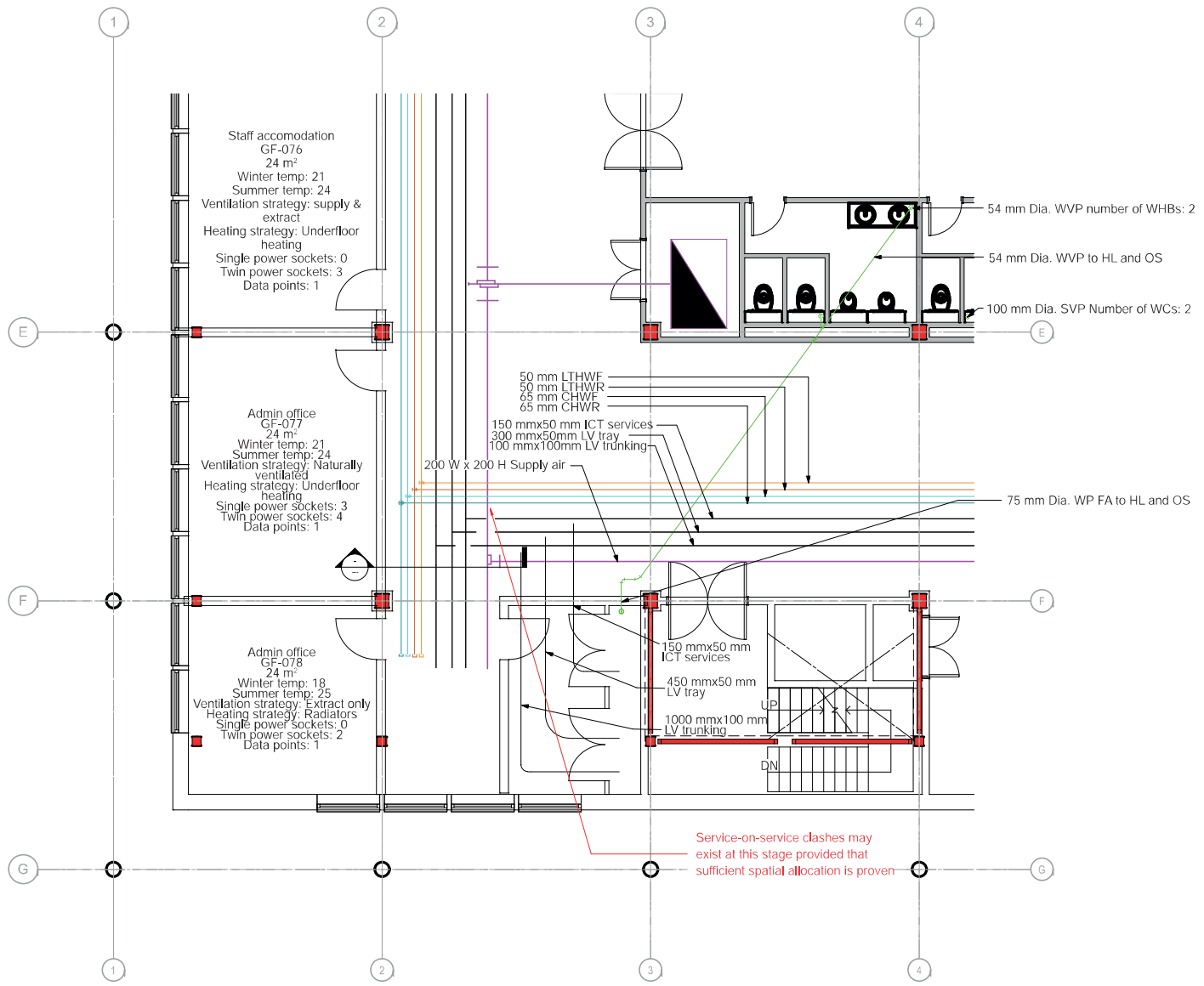




STAGE 3 DEVELOPED DESIGN MODEL DISTRIBUTION 3D VIEW

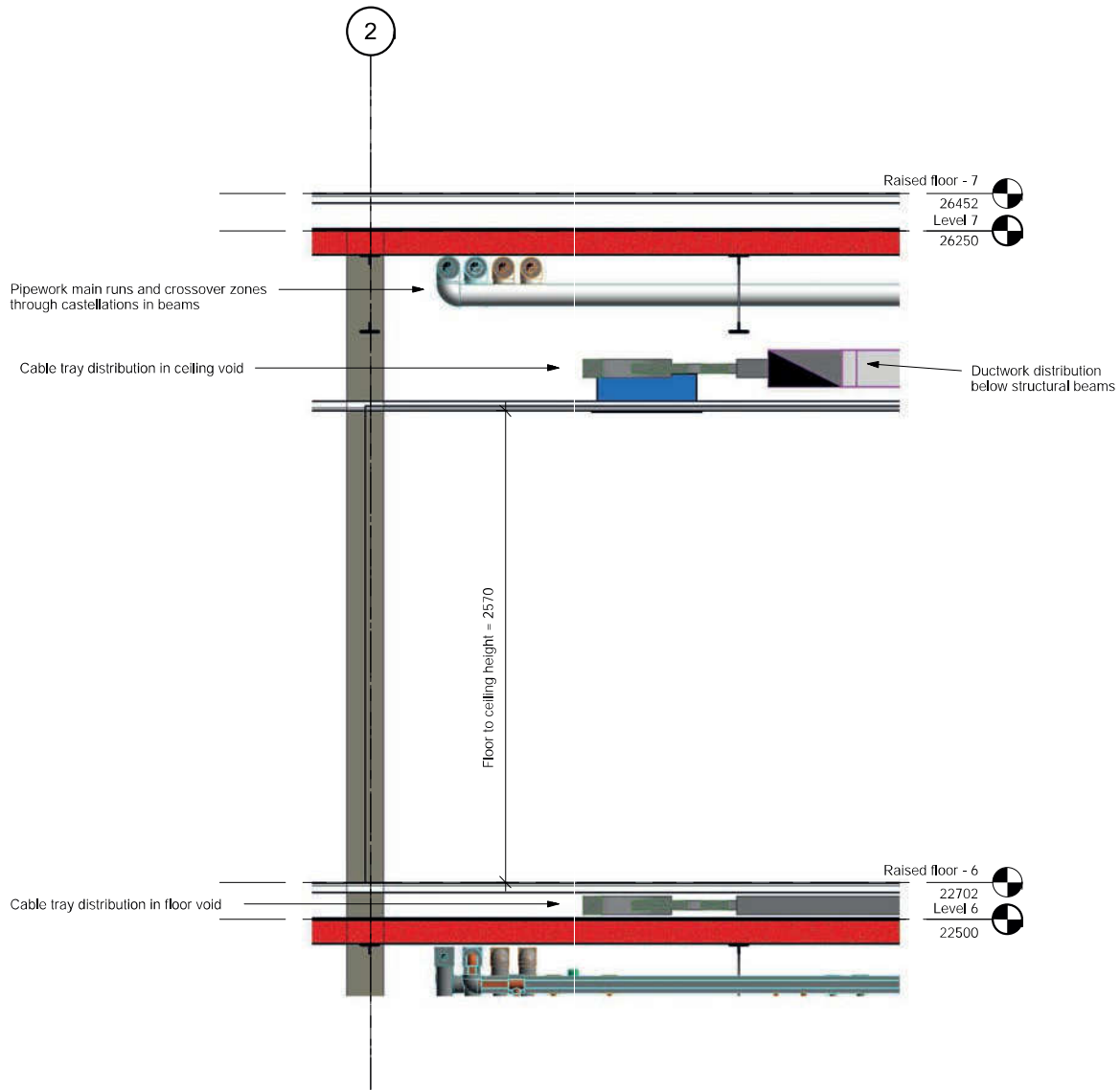






STAGE 3 DEVELOPED DESIGN DRAWING DISTRIBUTION LAYOUT

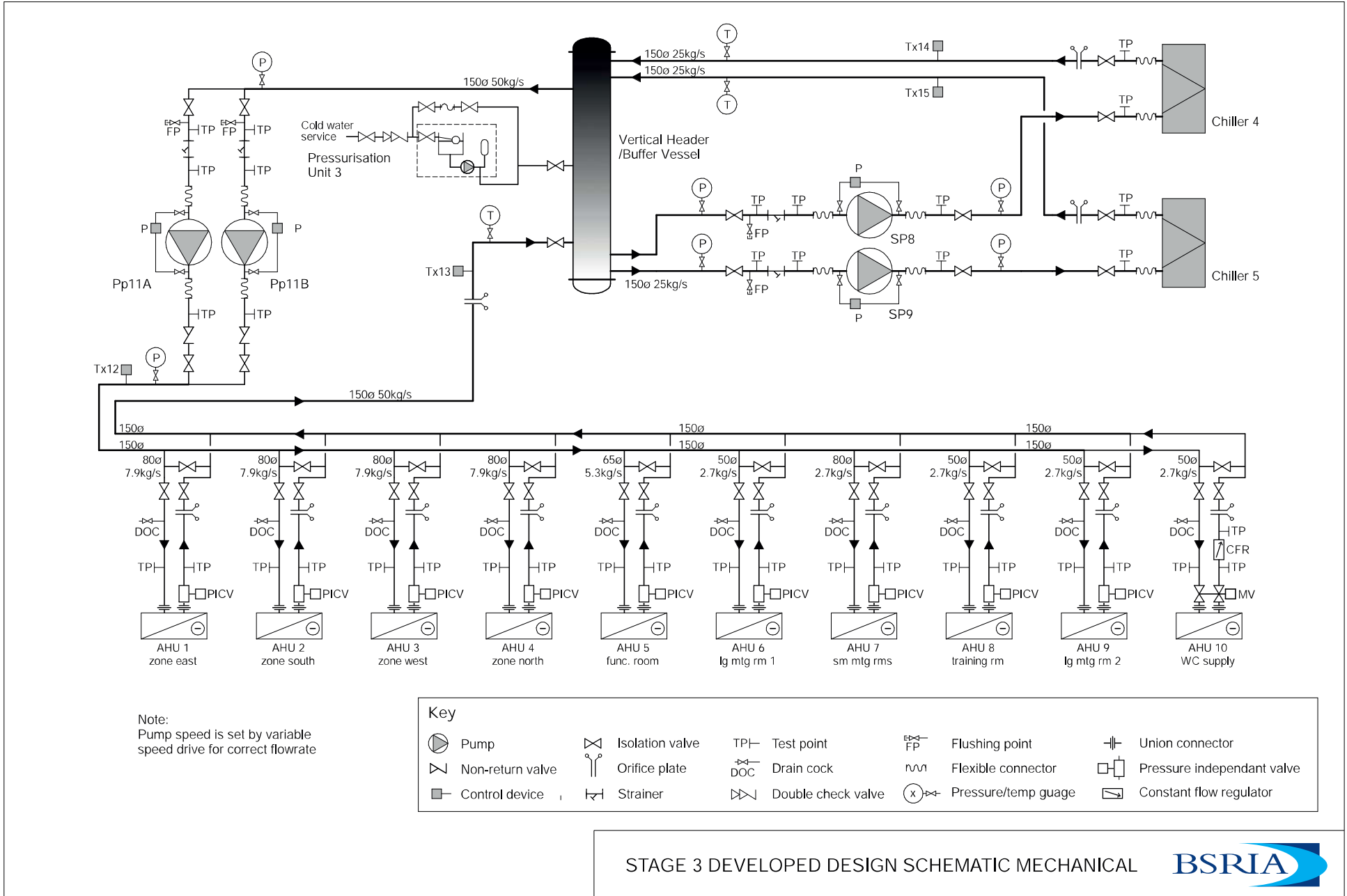




STAGE 3 DEVELOPED DESIGN DRAWING DISTRIBUTION SECTION







STAGE 3 DEVELOPED DESIGN SCHEMATIC MECHANICAL



