1.1 **GENERAL**

1.2 Related SFU Technical Requirements

1.2.1 Division 33 Utilities

1.2.2 Division 01:
- Section 01 77 00 Closeout Procedures
- Section 01 78 39 Project Record Documents
- Section 01 78 23 Operation and Maintenance Data
- Section 01 78 36 Warranties
- Section 01 78 45 Maintenance Materials
- Section 01 91 00 Commissioning
- Section 01 79 00 Demonstration and Training
- Section 01 35 05 SFU Policies, Work Procedures, and Forms
- Section 01 35 29 Health, Safety and Emergency Response Procedures

1.2.3 Division 27
- It is a requirement that all designs must operate within the University's current Network, Datacentre and I.T. Security infrastructure.
- Any projects that have components (listed below) that are directly or indirectly providing I.T. control and management features must be reviewed and approved by SFU Network Services.
  - Affected IT Components:
    - Network Ethernet Switches
    - Network Ethernet Routers
    - Controllers with Ethernet interfaces
    - Gateways with Ethernet interfaces
    - Servers and P.C. - standalone or virtual
    - Storage - Disk drives or SSD

1.2.4 SFU Mechanical Systems Design Checklist – Special Requirements SFU Surrey Warmup Checklist

1.2.5 Division 27A Audiovisual

1.3 Coordination Requirements

1.3.1 Coordinate with SFU Facilities

1.3.2 Coordinate with other design disciplines.

1.3.3 Coordinate with SFU IT for infrastructure or any network/communications requirements.

1.4 Description

1.4.1 These Design Guidelines apply to all Division 20 sections and all mechanical sections of Division 33.
2.1 MATERIAL AND DESIGN REQUIREMENTS

2.2 General

.1 The Mechanical Consultant shall submit to SFU Facilities a design philosophy for the proposed building mechanical, plumbing and fire protection systems. Major components of the philosophy must be accepted in principle by SFU Facilities before the project can proceed to construction. Consultants are expected to produce designs that meet User needs and allow SFU Facilities to continue to meet those needs in the future in a safe efficient manner.

.2 SFU buildings are generally not air conditioned for comfort. Cooling allowed for labs and server rooms where appropriate to meet functional requirements. Where conditions require air-conditioning, submissions for variance from this guideline are to be made as part of the initial submission of project design philosophy.

.3 All HVAC equipment such as boilers, chillers, variable speed drives, air handling units with unitary control panels must be BACnet compatible.

.4 Design spaces housing mechanical/electrical equipment with sufficient room for safe servicing, repair and replacement of equipment.

.5 All mechanical and plumbing designs shall be approved by SFU Facilities at Design Development, 60%, and 90-99% set. SFU Facilities comments must be considered and responded to in writing from consultants.

.6 Drawings shall show all mechanical and plumbing equipment in elevation or alternately shall specify mounting heights for the equipment.

.7 Submit to SFU Facilities a set of Issued for Construction drawings showing access paths to all equipment, paths for removal and replacement of proposed equipment and means of lifting equipment where its weight or its largest component exceeds 500 lbs.

.8 As Built/Record Drawings shall reflect all changes to specified means and access routes.

.9 Any variations from the prescribed Owners’ Technical Requirements must be approved in writing by SFU Facilities.

.10 Ladders: Where ladders are provided to access equipment, roofs or other locations, the latest regulations or at a minimum, the following shall apply:

   .1 A cage shall be provided for all ladders that exceed 16 feet in height or where there is a danger of a worker falling from the ladder to the ground level, roof or floor including an elevated access from a platform having less than 1.2 meters (48 inches) clearance between the ladder and any adjacent guardrail. The cage shall commence not more than 2.2 meters (7 ft.) above grade and continuing at least 90 centimeters (36 inches) above the top landing with openings to permit access by a worker to rest platforms or to the top landing.

.11 The mechanical consultant shall refer to SFU Mechanical Systems Design Checklist for special requirements on SFU Surrey campus. Ensure the details in the Warm-up checklist are met.
2.3 Mechanical Room Detail

.1 Locate Mechanical Rooms in areas accessible from outdoors. Confirm that sufficient space is provided to remove largest piece of equipment from the Mechanical Room.

.2 Mechanical Rooms to have no public access to room.

.3 SFU Facilities is considered as the User of all service spaces and Mechanical Rooms. Obtain SFU Facilities input and approval for Mechanical Room and routing of service spaces.

2.4 Building Management Systems

.1 SFU Facilities has a central monitoring and control facility for building Mechanical Systems including Plumbing, HVAC, Fire Protection and other systems. Simple remote (web-access) monitoring is also required on all projects. Comply Section 25 05 00 Building Management Systems (BMS) Design Guidelines.

2.5 Site Services – General Requirements

.1 Refer to Division 33 for materials and installation guidelines.

.2 Under no circumstances shall any utility piping extend under buildings as direct buried and in not readily accessible locations. Entire length of utility piping must be readily accessible after project completion. This includes steam, condensate, any gas piping, heating water, cooling water, domestic water, fire protection water, chilled water, and storm and sanitary drainage not related to the building.

2.6 Equipment List

.1 Engineer/Consultant to compile list of major equipment and materials for insertion into tender documents. Contractor to complete list with manufacturer's name and model number.

2.7 Equipment Installation

.1 On piping include unions or flanges for ease of maintenance and disassembly.

.2 Provide space for servicing, disassembly and removal of equipment and components. Follow recommendations of manufacturer.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

.5 Specify curbs under equipment and around pipe penetrations in mechanical rooms.

2.8 Electrical Motors

.1 Engineer/Consultant to include specification for motors when specifying packaged equipment.

.1 Example Only: Motor: EEMAC Class B, squirrel cage induction, 1725 r/min., continuous duty, drip proof, ball bearing, maximum temperature rise 40°C. Motors to be high efficiency and rated for inverter duty.

.2 Specify matched motors and variable frequency drives with low harmonic content and harmonic filters. Maximum acceptable harmonic content as per IEEE Standard 519 and 1100.
2.9 Fan Systems

.1 Selection of fan systems to consider maintenance and energy costs and sound levels. Final selection to be based on life cycle costs and to be approved by SFU Building Operations Technical Services.

.2 Direct drive fan systems are preferred.

2.10 Belt Drives

.1 Specify reinforced belts in matching sheaves. Multiple belts to be matched sets.

.2 Specify cast iron or steel sheaves secured to shafts with removable keys.

.3 For motors under 7.5 kW standard adjustable pitch drive sheaves, having plus or minus 10% range. Replace sheave with correct size after balancing.

.4 For motors 7.5 kW and over sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Specify sheave of correct size to suit balancing.

.5 Minimum drive rating 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

2.11 Testing and Balancing

.1 Testing and Balancing (TAB) shall be completed by accredited agency for all SFU projects with new or modifications to existing air, water/hydronic fluid systems.

.2 TAB Plan shall be provided by the agency prior to commencing work. Plan shall include but not be limited to:

- Project specific approach to balancing, including prerequisites, dependencies and deliverables
- Approach or considerations to systems that are not in scope (e.g., base building systems for TI projects)
- Testing methodologies and instruments
- Reporting methodology and frequency
- Method of issue resolution/reporting

.3 TAB report shall be submitted to the consultant and SFU facilities for review and approval within 5 working days of completion of TAB.

2.12 Drive Guards

.1 Specify guards for unprotected drives.

.2 Specify means to permit lubrication and use of test instruments with guards in place.

2.13 Unprotected Fan Inlets or Outlets

.1 Provide wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan inlet area.

.3 Securely fastened in place.

.4 Guards and screens to be removable for servicing.
2.14 Equipment Supports

.1 Specify for base mounted equipment chamfered edge housekeeping pads, minimum of 100 mm high and 50 mm larger than equipment dimensions all around. Provide engineered seismic restraints.

2.15 Preparation for Fire stopping

.1 Insulated pipes and ducts: ensure integrity of insulation and vapor barrier at fire separation.

2.16 Painting

.1 Refer to Section 09 90 00 Painting and Coating for additional painting specifications.

.2 Specify at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
2.17 Spare Parts

.1 Specify spare parts for any critical piece of equipment, or equipment which has a long lead time on parts. This is to be evaluated on a project by project basis as recommended by consultants and contractors prior to close out.

.2 Furnish the following spare parts in accordance with Section 01 77 00 Closeout Procedures, as follows:
   1. One casing joint gasket for each size pump.
   2. One head gasket set for each heat exchanger.
   3. One glass for each gauge glass.
   4. One set of belts for each belt driven piece of machinery.
   5. One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
   6. Parts shall be available from local suppliers.

2.18 Special Tools

.1 Provide one set of special tools including computer hardware and software required to service equipment as recommended by manufacturers and in accordance with Section 01 77 00 Closeout Procedures.

.2 Where greasing is required using non industry standard grease fittings, provide suitable adaptors for standard grease guns.

2.19 Access Doors, Materials and Installation

.1 Specify access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180° have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 In special areas such as tiled or marble surfaces, use stainless steel with mill finish.

.4 Remaining areas use prime coated steel.

.5 Locate so that concealed items are accessible.

.6 Locate so that hand or body entry (as applicable) is achieved.

2.20 Demonstration and Operating and Maintenance Instructions

.1 Prior to acceptance, specify tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment.

.2 Use operating and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.3 Ensure correct length of time for instruction is noted in appropriate specification section.

.4 Owner may record these demonstrations on video tape for future reference.

.5 Refer to 01 91 15 Commissioning Training for additional details on the initial commissioning training.
3.1 OPERATION AND MAINTENANCE MANUAL

3.2 General

.1 Refer to Section 01 78 23 Operation and Maintenance Data for detailed requirements.

3.3 Shop Drawings and Products Data

.1 Submit shop drawings and product data in accordance with Section 01 33 00 Submittal Procedures. Information shall include:
   .1 Mounting arrangements.
   .2 Operating and maintenance clearances. For example, access door swing spaces.
   .3 Equipment capacities and operating conditions.

.2 Shop drawings and product data shall be accompanied by:
   .1 Detailed drawings of bases, supports, and anchor bolts.
   .2 Acoustical sound power data, where applicable.
   .3 Points of operation on performance curves.
   .4 Manufacturer to certify as to current model production.
   .5 Certification of compliance to applicable codes.
   .6 Warranty information (extended or standard); standard warranties are for a period of 1 year from substantial performance.

3.4 Existing Systems

.1 Specify connections into existing systems to be made at time approved by Owner. Request written approval of time when connections can be made.

.2 Specify responsibility for damage to existing plant by this work.

3.5 Cleaning

.1 Specify cleaning of mechanical systems in accordance with Section 01 77 00 Closeout Procedures, 2.0 Cleaning.

.2 Specify cleaning of interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

.3 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

.4 Specify new filters at turn-over, clean switch gear and VSD serving mechanical equipment inside and out.

.5 Specify removal of construction debris from the mechanical/electrical rooms.

3.6 SFU Standard Details

.1 SFU Standard details, where provided, are for information only. Detailed design is the responsibility of the designer.

.2 Details will follow MMCD guidelines, as well as the respective envelope/infrastructure standard if applicable.

***END OF SECTION***