

DEP SPECIFICATION

HVAC FOR ONSHORE PLANT BUILDINGS

DEP 31.76.10.10-Gen.

February 2017

DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the indoor climate of onshore plant buildings and for the design and engineering of HVAC systems.

It takes into account the requirements for safety, operations and personnel.

Buildings that are not part of the process plant shall comply with local planning and building regulations. The principles of this document may be applied to such buildings where relevant but local regulations shall take precedence.

This DEP is applicable only to onshore installations. HVAC systems for offshore installations are covered by DEP 37.76.10.10-Gen.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM 1) – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2014; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in facilities related to oil refineries, chemical plants, gas plants and in exploration and production installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Air handling unit (AHU)	HVAC equipment that moves air and transforms it by means of filtration, control of temperature and control of moisture content. It typically comprises filters, fan(s), dampers, heating coil, cooling coil (thermal cooling and/or dehumidification). Humidifiers may be included in large AHUs or separately. Note that AHU sizes and configurations can vary widely. The internally located section of a split air-conditioning system is included as an AHU. A 'system' AHU serves multiple areas and is part of a system with distribution ductwork. A 'room' AHU serves only the room in which it is located. An AHU may be designed to work with 100 % fresh air, 100 % recirculation, or a mixture of both fresh and recirculated air.
Chiller	A packaged unit that provides chilled water for use as a cooling medium in AHUs and/or fan-coil units. The water is cooled by refrigerant in a vapour-compression system and heat, thus removed, is rejected via a condenser.
Cold Climates	Locations where the design ambient temperature ranges to below 0°C (32°F) for more than 24 hours.
Condenser	The heat-rejection part of a refrigerant vapour-compression cooling system. It is normally located externally in the form of a heat exchanger that is cooled by means of fans blowing ambient cooling air over it. If liquid cooling medium is available, a condenser may take the form of a shell and tube heat exchanger provided that operability criteria are fulfilled.
DCS	Distributed Control System. Also referred to as BPCS (Basic Process Control System)
Direct-expansion (DX) cooling	A refrigerant vapour-compression cooling system where the refrigerant directly cools a heat-exchanger (also referred to as evaporator) that has room or system air passing through it. The refrigerant is cooled by an external condenser.
(Dry-bulb) Temperature	The temperature of the air indicated by an accurate thermometer.
Electronic/Electrical equipment	Indoor electronic and electrical equipment, including microprocessor based control, safeguarding, telecommunication, computer, power supply and switchgear systems.
Fan-coil unit	HVAC equipment through which air is re-circulated from the space in which it is located. The purpose of this re-circulation is to cool or heat this air to the conditions required for the space. This unit is normally connected to the chilled water system.
Human comfort	Defined by the environmental parameters of temperature, radiation, humidity and air movement necessary for thermal comfort and depends on the individual's clothing and activity level.

Term	Definition
Humidity (Relative)	The ratio of the weight fraction of water vapour present in the air to the weight fraction of water vapour present in saturated air at the same temperature and barometric pressure.
HVAC system	A heating, ventilation and air-conditioning system which maintains required environmental conditions within rooms or buildings and also fulfils any safety-critical functions such as over-pressure, minimum flow rates and shutdown.
Interruptible, maintained electrical supply	A source of electrical power which is backed up by a second (emergency) source of power to provide a supply of electricity that may be interrupted for no more than 15 s.
Local Extract Ventilation (LEV)	Dedicated extract system to contain and remove fumes that are potentially injurious to health, such as welding fumes extract and fume cupboard extract.
MCC	Motor Control Centre
Plant buildings	Buildings such as control buildings, field auxiliary rooms (FARs), analyser houses, electrical substations and others (e.g., dedicated flow metering buildings). Such buildings may contain different types of rooms.
PAS	Process Automation System
Process-critical	Equipment or systems are process-critical if their failure could cause the process to shut down in a safe manner.
Safety-critical	Equipment or systems are safety-critical if they can cause or contribute to the occurrence of a major accident hazard (MAH).
Uninterruptible maintained electrical supply	A source of electrical power, which is backed up by a second (emergency) source of power to provide a supply of electricity that may be interrupted for no more than 0.5 ms.
Vital equipment	A service which, if it fails in operation or when called upon, can cause an unsafe condition of the process and/or electrical installation, jeopardise life, or cause major damage to the installation. Vital equipment generally covers both process-critical and safety-critical equipment and is used for consistency with other DEPs.
VSD	Variable speed drive for an electric motor.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (13).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2014. The following are the main, non-editorial changes.

Section/Clause	Change
All	Minor text editorial and update of informative data
3.1.2	Removed the note with alternate
4.3.2	Incorporated notes from Appendix A
4.5.2	Added item 2 to ensure battery rooms have negative pressure
5.1, 6.6.1	Incorporated notes from Appendix B.
5.2.2	Added clarification for non safety critical HVAC systems
5.8	Clarified location of chiller piping
All	Updated references

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://www.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL

1. Plant buildings and facilities may require HVAC systems to fulfil the following functions:
 - a. safety-critical functions: compliance with area classification requirements to reduce risk levels;
 - b. process-critical functions: to maintain suitable conditions for equipment operation;
 - c. human comfort: to maintain conditions suitable for personnel to work;
 - d. human welfare: to prevent personnel from being exposed to potentially hazardous substances.

3. HVAC PHILOSOPHY

3.1 HVAC FUNCTIONS

3.1.1 General

1. For each plant/installation a HVAC design philosophy shall be established at the start of the project.

3.1.2 Process safety requirements

1. HVAC design SHALL [PS] incorporate the following process safety functions:
 - a. pressurisation of non-hazardous enclosed facilities to a level above the pressure of an adjacent hazardous area when the non-hazardous area boundary is in contact with the hazardous area and the segregating structure is not gas-tight;
The level of pressurisation is determined by the applicable area classification code.
 - b. provision of ventilation airflow rates for hazardous facilities at a rate meeting the requirements of 'adequate' as defined by the applicable DEP 80.00.10.10-Gen. or DEP 80.00.10.13-Gen.
 - c. HVAC equipment located in a hazardous area or potentially handling a flammable mixture of air and gas to be designed, constructed and certified in accordance with applicable standards (e.g., CSA, ANSI / NEMA or IEC) to prevent it from igniting the gas to which it may be exposed;
 - d. gas shut-off dampers to be installed at air intakes and outlets of;
 - i. non-hazardous buildings where there is risk of flammable gas being present;
 - ii. mechanically-ventilated hazardous facilities where the safety philosophy is based on containment of hazards during abnormal situations.
 - e. mechanically-ventilated enclosed hazardous facilities to be negatively pressurised where the safety philosophy is based on containment during normal operation;
 - f. HVAC systems to shut down (including closure of fire/gas dampers) when required to do so by Fire & Gas or Safety design requirements;
 - g. battery rooms to be ventilated to prevent accumulation of hydrogen gas.
2. HVAC equipment located in a non-hazardous area may need to be constructed and certified in accordance with applicable standards (e.g., CSA, ANSI / NEMA or IEC) for use in a hazardous area as required by site safety philosophy.

3.1.3 Safety-critical functions

1. The design and function of HVAC systems shall comply with the governing area classification standard.
 - a. Refer to DEP 80.00.10.10-Gen. and DEP 80.00.10.13-Gen.
2. Safety-critical functions shall be determined in conjunction with Safety discipline.
3. The design shall document how the following safety-critical functions are addressed:
 - a. pressurisation of non-hazardous areas;
 - b. segregation of hazardous and non-hazardous areas by means of impermeate structure;
 - c. gas detection at HVAC air intakes;
 - d. fire/gas dampers to close the air intakes and outlets of a building;

This is required as a minimum for buildings that remain occupied and have control/monitoring functions following a major release.
 - e. classification of HVAC equipment that could be exposed to flammable gas, including classification requirements for externally-located HVAC equipment to prevent it from acting as an ignition point even if located in a non-hazardous area;
 - f. site gas detection and tripping philosophy;

For example, the likelihood of detection systems to detect a major release and trip or to detect ignition sources before the release can reach potential points of ignition.
 - g. the leak-tightness of buildings containing equipment that will remain live and could be affected by a gas cloud following a major release event;
 - h. ventilation rates of hazardous areas in relation to area classification requirement;
 - i. availability of power in situations when safety-critical functions are required;
 - j. ignition risk posed by external HVAC equipment and HVAC systems for non-hazardous buildings located outside hazardous areas;

Area classification is usually based on normal plant operation, but there might be the possibility of larger hydrocarbon release events spreading beyond the normal hazardous area classification zones, such as major accident hazard events. If the risk of such an event poses a threat to the installation, it is necessary to consider a hierarchy of safety measures that include those mentioned above.
 - k. requirements for a Safe-Haven or Temporary Refuge.

Note that the design of plant layout will often enable areas of different classification to be suitably segregated by distance, but it is necessary to assess the areas of risk and eliminate or address them as appropriate.
4. The design philosophy shall state whether safety-critical functions are applicable or non-applicable and which facilities they apply to.
5. The design shall enable management of the HVAC systems safety-critical elements during the operations phase.

Management of HVAC systems during the operations phase includes testing to demonstrate the continuing suitability of HVAC safety-critical elements.

3.1.4 Process-critical functions

1. The design shall document how the following process-critical functions are addressed:
 - a. adequate equipment ratings to provide a suitable operating environment during normal operation;
 - b. equipment sparing to allow for reliability and maintenance issues;
 - c. availability of electrical power and the sources of power supplies used for HVAC systems;
 - d. equipment tripping philosophy and operation in emergency conditions.

3.1.5 Human comfort

1. The design shall document how the following human comfort considerations are addressed:
 - a. air quality, temperature, humidity and sound;
 - b. work patterns and whether or not buildings are considered “occupied”.

3.1.6 Human Welfare

1. HVAC systems may be required to reduce the risk of personnel being exposed to potentially harmful substances.

Examples are welding fumes extract systems and fume cupboard extract systems.

3.2 DISCIPLINE INTERFACES

1. The design and functional requirements of HVAC systems shall incorporate the requirements of other disciplines:
 - a. interdiscipline communication shall be included within the design process for HVAC systems.
 - b. the following main discipline interfaces should be included:
 - i. electrical;
 - 1). power supplies and availability of power in abnormal situations;
 - 2). information about equipment heat emissions and required operating environments for equipment, including batteries.
 - ii. control and automation;
 - 1). control, monitoring and alarm functions;
 - 2). gas detection and tripping philosophies;
 - 3). information about equipment heat emissions and required operating environments for equipment.
 - iii. process safety, technical safety;
 - 1). safety philosophies and design documents to obtain information about sources of potential hazardous events and consequences of releases;

iv. civil/architecture;

- 1). layouts of buildings, space to accommodate HVAC equipment, equipment supports, raised floors to enable upward airflow for rooms with high intensity heat emissions;
- 2). details of fabric for determining thermal transfer coefficients;
- 3). standard of leak-tightness;

If there is a requirement for buildings to achieve a standard of leak-tightness, e.g., for pressurisation or to resist gas ingress, the building construction must take this into account. It is important for requirements to be made known to Civil/Architectural discipline.

- 4). segregation between hazardous and non-hazardous classified areas.

If any parts of a building or structure provide segregation between hazardous and non-hazardous classified areas.

v. piping;

- 1). chilled water;
- 2). piped heating or cooling medium;
- 3). drain pipes from HVAC equipment, e.g., from cooling coils.

3.3 LIFECYCLE

1. HVAC systems shall be designed for longevity and ease of maintenance commensurate with the whole life of the installation.

4. DESIGN CONSIDERATIONS

4.1 INTERNAL DESIGN CONDITIONS

1. Refer to (Appendix A, Table A.1) for normative internal design conditions:
 - a. unoccupied equipment room temperatures may exceed the normal maximum design value for short periods provided that they are within the tolerance of the particular equipment to be installed and agreed with the applicable discipline;
 - b. battery rooms may be designed for a smaller temperature range, e.g., 15°C-25 °C (60 °F - 77 °F);
 - c. battery room requirements shall be confirmed with the battery Manufacturer.

This is based on:

 - occupied rooms: temperature 20 °C - 24 °C (68 °F - 75 °F), relative humidity 30% - 75%;
 - equipment rooms: temperature 5 °C - 27 °C (41 °F - 80 °F), relative humidity 20% - 80%.
2. HVAC design shall prevent condensing moisture on the surfaces of building fabric and equipment.
3. For arctic climates, the normal relative humidity values as listed in Appendix A, Table A.1 may be lowered subject to the approval of the Principal.

Arctic climates typically have low air humidity.
4. Humidity control may be necessary to obtain acceptable conditions for equipment or personnel, but the use of humidification equipment shall be subject to the Contractor submitting a justification (e.g., based on human welfare issues or equipment operation problems) to the Principal and obtaining agreement.

5. Humidity control shall be provided where compliance with temperature requirements will not maintain humidity within acceptable limits for the majority of the time.
6. For design and operation of fire, gas and smoke detection systems, refer to DEP 32.30.20.11-Gen.
7. Chilled water pipework and refrigerant pipework shall be part of the HVAC system. (See 6.1).

4.2 EXTERNAL DESIGN CONDITIONS

4.2.1 Extreme Temperatures

1. Extreme temperatures of short duration and low frequency (as specified by the Principal based on evaluation of return period and equipment cost) shall not be used as HVAC design values.

These temperatures might be of such short duration and low frequency that it is not justified to use them as a basis for equipment sizing.

2. HVAC equipment shall be specified so that it is capable of surviving without degradation of its functional capability during extreme temperatures.

4.2.2 HVAC Design Conditions

1. External design conditions shall be based on weather data (e.g., Metocean data) recorded over several years and applicable to the particular location:
 - a. design dry-bulb temperatures shall be based on;
 - i. the upper temperature shall be the highest temperature that is exceeded for 1% of the year;
 - ii. the lower temperature shall be the lowest temperature that is exceeded for 99% of the year.
 - b. the values, durations and frequencies of conditions that are to be used shall be subject to review by the Principal;
 - c. design relative humidity values shall be based on a review of data for coincident values of humidity and dry-bulb temperatures so that the range of conditions is covered.

4.3 AIR QUALITY

4.3.1 Fresh Air

1. HVAC systems shall provide fresh air for the following situations:
 - a. buildings classed as “occupied” (e.g., control building);
 - b. buildings where pressurisation is required;
 - c. for battery rooms, workshops and laboratories that have dedicated extract systems: to replace air extracted and to ensure the extract function is not impaired by air starvation;
 - d. for toilets, to make-up for air extracted (air is supplied to other areas and transfers to toilets);
 - e. optionally, and where feasible, fresh-air may be used for cooling to eliminate a requirement for other forms of cooling;
 - f. for enclosed hazardous-classified facilities where air-change rates must meet particular requirements for adequate dilution ventilation in accordance with the applicable area classification code.
2. Other non-hazardous plant buildings that are not classed as “occupied” shall not require fresh air ventilation.

The opening of doors for occasional visits by operations or maintenance personnel will provide adequate air refreshment.
3. The fresh air flow rate should be kept to a functional minimum to reduce the energy required to heat, cool or dehumidify outside air, except for climates where fresh air cooling is feasible:
 - a. if the desired pressurisation level is the determinant for the fresh-air flow rate, the building or structure should be made as air-tight as reasonably possible.

Fresh-air flow based on what is required to reliably obtain the desired pressurisation level might be the determinant for the design fresh-air flow rate.
4. Refer to ASHRAE 62 for guidance on the rates of fresh air required to provide acceptable indoor air quality.
5. Fresh air systems shall be tempered by primary heating/cooling to reduce temperature and humidity to levels that are suitable to introduce to the rooms unless the fresh air is introduced directly to the intake of the AHU that serves the rooms/building.

4.3.2 Airborne particulate contamination

1. Fresh and recirculated air systems shall comply with the grades shown in (Appendix A Table A.1) which has the following notes:
 - a. the set point for Normal DB Temp shall be adjustable within the 'normal' temperature range stated in Appendix A;
 - i. set point tolerance shall not exceed +/- 1 °C.
 - b. the set point for Normal % RH shall normally be set in the range 40% - 50% relative humidity as appropriate for climate;
 - i. set point tolerance shall not exceed +/- 5% RH.
2. Fresh air filters shall be bag-type in order to extend maintenance intervals.
3. In regions where airborne sand and dust can arise, air intakes shall include protective measures such as sand louvres, traps, and high capacity filters.
4. Condenser units shall be protected.
5. Equipment performance shall include an allowance (approved by the Principal) for prevailing levels of air contamination.

4.3.3 Chemical contaminants

Chemical contaminants might cause corrosion and affect the reliability of electronic equipment at very low concentrations, and combinations of contaminants might cause corrosion rates even higher than those of individual components.

1. Reference standards are IEC 60654-4 and ISA-S71.04.
2. Chemical contaminants can be removed by the use of charcoal-bed filter/scrubbers, but their use is not recommended because they require regular changing of the media.
3. Charcoal-bed filter/scrubber units shall not be used unless there is a proven risk of chemical corrosion.
4. Hydrogen sulphide absorption filters shall generally be included at air intakes at installations where there is risk of H₂S contamination.
5. The use of hydrogen sulphide absorption filters shall be determined and agreed in conjunction with the Principal.

4.3.4 Cold climates

1. Measures shall be taken to prevent filters from freezing in cold climates.

The following are typical measures:

- *recirculating a quantity of warmed air from the discharge side of the fan(s) to the upstream side of the filter;*
- *using a pre-heater.*

4.4 CALCULATIONS

1. Calculations shall be undertaken to establish required airflows, equipment sizes and duties.
2. Recognised design software packages shall be used to establish building heating and cooling design:
 - a. the proposed software shall be submitted to the Principal for acceptance.
3. Calculations for building heating and cooling requirements shall include the following:
 - a. thermal properties of building fabric;
 - b. heat losses at winter design conditions;
 - c. heat gains and cooling duty, including lighting, solar gains and equipment gains;
 - i. calculations of heating requirements shall include an allowance for heat gains from lighting and equipment in cases where the heat gains will usually be present;
 - ii. heat emissions data for use in calculating cooling requirements shall be based on equipment Manufacturer's heat emission data;
 - iii. design cases where the heat gains are not present, such as "plant black-out" or "during construction" shall be addressed in the design documentation.
 - d. airflows required to provide heating and cooling without excessive temperature differentials;
 - e. flow rate for fresh air, airflow required for pressurisation;
 - f. duct flow and resistance calculations;
 - g. HVAC sound level calculations;
 - h. clear statements of required equipment duties.
4. Calculations shall be subject to acceptance by the Principal.

4.5 DESIGN AIR-CHANGE RATES

4.5.1 General

Prescriptive airchange rates apply to the following facilities:

4.5.2 Battery Rooms

1. Minimum ventilation rates for rooms containing battery sets shall be calculated in accordance with EN 50272, battery Manufacturer's instructions and information about gas emission rates and ventilation, and use of the battery charging system.
2. Battery room pressurisation should be negative relative to adjacent rooms.

4.5.3 Toilets

1. Airchange rates for toilets shall be the greater of:
 - a. 6 litres/sec per WC, or 3 air-changes/hour;
 - b. requirements of local regulations.

4.5.4 Analyser Shelter

1. Refer to DEP 32.31.50.13-Gen.

4.6 BUILDING LEAKAGE

Note that standard methods of building construction might not provide adequate sealing for buildings that are required to be pressurised.

1. If pressurisation is necessary, the Contractor shall ensure that the building design (materials, detailing and construction) meets the requirement to minimise building leakage:
 - a. refer to Annex F of DEP 37.76.10.10-Gen. in the context of offshore TRs for measuring building leakage after construction using the blower-door methodology.

4.7 AREA SEGREGATION

1. Non-hazardous and hazardous classified areas that are adjacent may be segregated either by pressurisation or by ensuring that the segregating structure is completely gas-tight and will remain so without maintenance.

4.8 ENERGY EFFICIENCY

1. HVAC services shall be designed to be as energy-efficient as practicable in the context of operating and maintaining plant buildings.

4.9 SOUND AND VIBRATION

1. Sound levels caused by HVAC equipment shall be at least 5 dB(A) below the design sound levels in DEP 31.10.00.31-Gen.

HVAC sound levels can be reduced by applying the following measures:

- *designing for low sound levels, e.g., by use of low duct velocities, low-speed rotating equipment;*
- *duct sound attenuators;*
- *cross-talk attenuators;*
- *isolation of rotating and vibrating equipment from ducts, pipes and supporting structures by means of flexible connections and anti-vibration mounts.*

4.10 ABNORMAL OPERATIONAL SITUATIONS

4.10.1 Equipment operation

1. HVAC systems shall be devised to run (e.g., to provide cooling) in abnormal situations to enable the continued operation of process- or safety-related equipment and prevent failures or shut-downs.

Typically, the following equipment will be required to stay operating in all situations:

- *all electronic process control and safeguarding equipment, including process data recording;*
- *all fire and gas detection and control equipment;*
- *all plant telecommunication equipment, including CCTV;*
- *UPS systems.*

The equipment required to stay operational in all situations could dictate particular arrangements of HVAC systems regarding redundancy and configuration (e.g., dedicated plant versus centralised).

4.10.2 Power availability

1. HVAC equipment shall be connected to emergency power supplies (diesel generator) where functions must continue in the absence of the normal power supply.

The availability/capacity of the emergency power supply could impose constraints on the number and size of electrical equipment that can be connected to it.

Constraints on the number and size of electrical equipment that can be connected to the emergency power supply could require smaller independent HVAC systems for facilities maintained operating by emergency power.

4.10.3 Blast events

1. If externally-located HVAC equipment is required to continue to operate after a blast, it shall be able to withstand the blast forces to which it will be exposed.

Typically the equipment is located where it will be exposed to the least blast overpressure (e.g., shaded from the blast by the building).

4.11 SERVICE LIFE

1. The specification of HVAC equipment shall be based on obtaining service life to suit the life-time of the installation.
2. The specification of HVAC equipment shall encompass life-cycle costs, materials specifications, maintenance requirements, replacement of major components or whole replacement if this would be more economic than repair.

4.12 DUCT AND PIPE CONDENSATION INSULATION

1. Condensation on air ducting and chilled water piping shall be prevented under all stated climatic conditions (4.2.2):
 - a. insulation shall be installed where necessary to prevent condensation on air ducting and chilled water piping;
 - i. refer to DEP 30.46.00.31-Gen.

4.13 HVAC EQUIPMENT DRAINAGE

1. Refer to Appendix D.12.
2. Condensate shall be drained to a drain point outside of the building.
3. The design shall include provisions to avoid freezing of steam condensate lines and drain lines.
4. The design shall manage the risk of leaking or overflowing condensed water within refrigerant systems.

5. HVAC SYSTEM DESIGN - GENERAL

5.1 AIR INTAKES AND OUTLETS

1. Air intakes (and outlets where stated) shall meet the following requirements:
 - a. located in a non-hazardous area and as far from hazardous zones as reasonably practicable;
 - b. located at a high enough level to reduce the risk of drawing-in heavier-than-air gas, if required by hazardous areas or where there is risk of sand or dust storms;
 - i. high level air intake may either be incorporated into the building structure or be an elevated vertical stack for single-storey buildings.
 - c. vertical stacks shall include a weather cowl and bird screen at the top;
 - i. the weather cowl shall not require maintenance through its design life;
 - ii. vertical stacks shall include a baffle arrangement to divert particulate matter to the base from where it can be removed by means of a removable door.
 - d. In locations subject to sand or dust storms, all air intakes shall meet the following requirements;
 - i. be designed to allow for sand/dust being entrained with outside air;
 - ii. include sand louvres and sand traps;
 - 1). sand traps shall be sized so that they do not require cleaning more frequently than once a month or after a sand storm;
 - 2). sand traps shall be located so that they are easily accessible for cleaning.
 - e. if vertical stacks are not employed, air intakes shall have a downward-facing 90° cowl, with bird screen, to protect from rain and wind effect;
 - f. air outlets shall have downward-facing 90° cowls;
 - g. in locations subject to heavy snowfall, air intakes and outlets shall be suitably elevated and clear of structure such that they cannot be blocked by snow build-up;
 - h. air intakes and outlets shall be suitably separated so that exhausted air will not be ingested;
 - i. the location of the exhaust shall not result in harm to people or the environment.