#### DESIGN CHECKLIST

PROJECT NAME		
DISCIPLINE	DATE	_TYPE REVIEW
REVIEWER	DRAWINGS REVIEWED_	

# EVERY ITEM WILL BE REVIEWED AND NOTED FOR COMPLIANCE (C), OR NON-APPLICABILITY (NA).

#### SECTION 7 – PLUMBING

#### A. GENERAL

ITEM NO. CHECK

## <u>ITEM</u>

- 1. \_\_\_\_ Pipe Concealment spaces, furring, or chases are adequately sized and coordinated with Architect.
- 2. \_\_\_\_ Isometrics riser diagrams are provided for each plumbing and compressed air system, etc.
- 3. \_\_\_\_ The distance from vent to fixture trap conforms to Design Instructions Manual and the International Plumbing Code.
- 4. \_\_\_\_ The water heater design data schedule on the plans agrees with the design analysis and that it includes the storage capacity and hourly recovery.
- 5. <u>An air gap or indirect waste is provided on all food service</u> equipment as required by the International Plumbing Code.
- 6. \_\_\_\_ Hose faucets around the outside of the facility are provided as required by the Technical Manual for Plumbing. Verify the wall hydrants are not specified when hose faucets are intended.

- 7. \_\_\_\_ The grades of all drain lines are accurately calculated and that the invert elevations are established and indicated on the drawings.
- 8. \_\_\_\_ Electrical drawings indicate power to pumps and water heaters. All power characteristics should be shown on mechanical plans.
- 9. \_\_\_\_ Equipment schedules indicate the necessary units, capacities, types, sizes, special notes, etc.
- 10. \_\_\_\_ When specifications phrases such as "show on plans" or "as indicated" are used, the requirement is shown on plans.
- 11. \_\_\_\_ Water hammer arresters for fixtures are provided for groups of about four fixtures instead of at each faucet, control valve, or flush valve except where quick-acting valves are installed. See special note in back of applicable guide specification about when these may be left out.
- 12. \_\_\_\_ The types and sizes of drinking water dispenses are coordinated with the Architect. Drinking water dispensers are sized in accordance with the Technical Manual for Plumbing and that the type and size are placed in the equipment schedule. Note that the size does not refer to the physical dimensions but to the cooling water capacity. Provide sufficient numbers of water dispensers or coolers to service the needs of the proposed number of building occupants and so that the occupants do not have to travel more than the specified number of feet to reach a dispenser.
- 13. \_\_\_\_ Water heaters greater than 20 gallons in capacity should have a dual type heating element. Designs having a single heating element and lesser capacity require a tailor-made specification.
- 14. \_\_\_\_\_ Under Certain Conditions vacuum relief valves are specified for the cold water connection to electric water heaters. A check valve is unacceptable. Location of relief valves should be in accordance with the International Plumbing Code.

15.	 Vapor barrier or other protective jacket and the insulation are specified for insulated hot and cold water pipes. Insulation of cold water piping may not be required for some sites if the water temperature is high. A/E should determine whether insulation is needed based on water temperature and ambient air temperature.
16.	 In buildings taller than two stories or where the total stack height is greater than 35 feet, extra heavy soil pipe, not service weight pipe, is used.
17.	 Flow diagrams agree with the actual piping and equipment arrangements shown on the plan drawings.
18.	 Verify that adequate space is available for piping in kitchens and bathrooms.
19.	 Separate drawings are provided for drain –waste-vent piping, domestic waste piping, and mechanical process piping.
20.	 Non-potable water is not provided to interior domestic water piping, and food preparation and bathing areas.
21.	 A complete legend and list of abbreviations for plumbing is provided.
22.	 Electric heating elements in food warming tables have automatic shutoffs to prevent element failure when low water situations occur.
23.	 Shop floors slope away from equipment and hydraulic lift shafts and toward floor drains which are adequate in size.
24.	 Air and water are available for vehicle use external to shops and maintenance bays in order to avoid using the bays for checking water in radiators or air in tires.
25.	 Water sources and/or waste and water piping should not be located above (or on the floor above) electrical switch gear or transformer rooms.
26.	 Floor drains are provided in rooms and areas with fire pumps.

27.	 When applying self closing valves verify that the available minimum water pressure will be capable of closing the valve.
28.	 In facilities subject to shock, water storage tanks should be provided with a flexible PVC liner in lieu of coatings.
29.	 Verify that plumbing access panels have been included and specified.
30.	 Verify that the specifications do not allow the usage of polybutylene piping.
31.	 The design incorporates seismic requirements based on the seismic zone for the project location.
32.	 For projects in Qatar, provide a 3-day domestic water storage at each facility for compliance with local Qatari code.

## B. SPECIAL NOTES

- 1. <u>Coordinate plumbing plans with exterior site plans and with exterior utilities.</u>
- 2. \_\_\_\_ When no central water softening system is available, check water analysis for hardness. If required, provide water softeners in accordance with applicable technical manuals. Coordinate with civil engineer; as appropriate.
- 3. \_\_\_\_ Check minutes of all conferences to ensure that all comments have been complied with.
- 4. \_\_\_\_ Check preliminary review comments for compliance.
- 5. <u>Check to see that the instructions have been complied with in</u> respect to listing Government furnished equipment.
- 6. <u>Check project criteria for instructions concerning plumbing</u> requirements.

7. \_\_\_\_ For all items, compare specifications to be used with the International Plumbing Code.

# C. PROPRIETARY MATERIALS AND EQUIPMENT

# <u>INITIAL</u>

To the best of my knowledge, the specifications and drawings do not include any proprietary or sole source materials or equipment except for the following approved items:

#### DESIGN CHECKLIST

PROJECT NAME\_

DISCIPLINE	DATE	_TYPE REVIEW
REVIEWER	DRAWINGS REVIEWED	

# EVERY ITEM WILL BE REVIEWED AND NOTED FOR COMPLIANCE (C), OR NON-APPLICABILITY (NA).

# <u>SECTION 8 – HEATING, VENTILATION, AIR CONDITIONING, AND</u> <u>REFRIGERATION SYSEMS</u>

#### 1. <u>HEATING SYSTEMS:</u>

A. GENERAL

#### ITEM NO. CHECK

## <u>ITEM</u>

- 1. \_\_\_\_ Equipment room layouts and access to those rooms afford adequate space for operation and maintenance or replacement of the equipment to be installed. Check against the dimensions of a minimum of three manufacturers.
- 2. \_\_\_\_ No interference exists between heating layout and items shown on structural, electrical, and architectural drawings.
- 3. \_\_\_\_ Control sequence of operation outlined in the specifications agrees with design and the control diagram on the drawings. All mechanical equipment with controls should be included in the control diagram and this diagram located on the mechanical drawings.
- 4. \_\_\_\_\_ Fire damper and fire door located as shown on the design drawings coincide with the locations of fire rated separation. In addition fire dampers and fire doors are properly detailed.

- 5. \_\_\_\_ Duct-mounted smoke detectors are properly located, interlocked with the building fire alarm system and connected to provide desired control function.
- 6. \_\_\_\_ The design incorporates seismic requirements based on the seismic zone for the project location.

## 2. VENTILATION SYSTEMS

## A. GENERAL

## ITEM NO. CHECK

**ITEM** 

- 1. \_\_\_\_\_ Fire damper and fire door locations as shown on the design drawings coincide with the locations of fire rated separation. In addition fire dampers and fire doors are properly detailed.
- 2. \_\_\_\_ Specification reference "where shown", "as indicated", etc., are included on plans.
- 3. \_\_\_\_ In explosion proof areas, explosion proof and spark proof requirements are met.
- 4. \_\_\_\_ Electrical characteristics for fans, damper motors, etc., are shown on mechanical sheets.
- 5. \_\_\_\_ Fan openings in buildings and louver openings in walls, doors, and ceilings are shown and detailed on plans. Are proper access openings to piping and equipment shown on plans? Coordinate with the architectural and structural plans.
- 6. \_\_\_\_ Fan curb details at all building penetrations are detailed completely.
- 7. \_\_\_\_ All areas requiring mechanical ventilation have both supply and return air paths completely detailed and shown.
- 8. \_\_\_\_ Pressure classifications of ductwork are shown where required.

9.		Shower rooms are well ventilated with either a clean sweep of air across the top of all showers or that an individual exhaust register is provided in each shower enclosure.
10.		Pits in automotive shops and other areas where concentrations of vapors can be hazardous or dangerous, are properly ventilated and comply with the appropriate NFPA Code.
11.		Fans or equipment located in or adjacent to sleeping rooms and other "quiet" areas such as conference rooms, auditoriums, libraries, or office space will not create a noise problem. This equipment should be provided with suitable vibration isolation or acoustical treatment.
12.		Clear control or operation instructions are provided. Drawings are to indicate location for all control items.
13.		All openings or louvers are equipped with dampers or backdraft devices to prevent sand and dirt entry during sandstorms in accordance with MED criteria.
14.		All buildings are maintained at a positive pressure to eliminate sand and dirt infiltration.
15.		Insect or bird screen are provided on all openings such as outside air intakes and louvers where required.
16.		All equipment rooms and janitor closets are properly ventilated.
17.	_	The drawings provide flow diagrams for all systems so that the system logic is immediately obvious.
18.		Exhaust fans in the vicinity of dishwashers have sufficient capacity for the hot, moist air present.
19.		Duct-mounted smoke detectors are properly located, interlocked with the building fire alarm system and connected to provide the desired control function.
20.		A complete legend and list of abbreviations for ventilation systems is provided.

- 21. \_\_\_\_ Domestic clothes driers have proper air vents to outside and make-up air is provided for them.
- 22. \_\_\_\_ The design incorporates seismic requirements based on the seismic zone for the project location.

## 3. AIR-CONDITIONING SYSTEMS

A. GENERAL

## ITEM NO. CHECK

<u>ITEM</u>

- 1. \_\_\_\_\_ The schedules on the plans are complete with all of the details necessary to purchase equipment. The information scheduled (e.g. heat loads) will be used by an equipment buyer to purchase a specific manufacturer's piece of equipment. The information must be the calculated values required, not an amount available from a particular manufacturer's product.
- 2. \_\_\_\_ Minimum outside air requirements are indicated in the equipment schedule and at the outside air intake or on the control diagram and that the figure indicated on the drawings agrees with the design analysis.
- 3. \_\_\_\_ Adequate space is available around condensers or chillers to allow for rodding or removal of tube banks, or any other service or replacement.
- 4. \_\_\_\_ Details are provided on the plans of evaporators and coils showing proper valves, strainers, gages, thermometers, sight glasses, equipment controls, piping connections, etc.
- 5. \_\_\_\_ Adequate room around air handling units is shown on plans to provide maintenance of filters, coil cleaning, valve and damper adjustment, etc.
- 6. \_\_\_\_ Plans or standard details indicate pumps and control valves to be flanged or unions provided to allow removal for maintenance.
- 7. \_\_\_\_ Duct runs and piping are not in conflict with the work shown on other sheets of the plans or with architectural or structural features of the facility.

- 8. \_\_\_\_ Access panels are provided on architectural plans to permit access to concealed duct dampers, heating coils, etc., that must be adjusted or maintained.
- 9. \_\_\_\_\_ An isometric layout is included on the drawings for the refrigerant piping, showing the relationship of the piping to equipment as well as to the walls, floor and ceiling of the space, and the amount and direction of pitch and suction and hot gas lines and oil traps for proper oil return. In the absence of an isometric, several sections through the equipment room containing this information should be shown.
- 10. \_\_\_\_ The condensing water pump is low enough with respect to the cooling tower basin to provide flooded suction at all times.
- 11. \_\_\_\_ Refrigeration piping is designed in accordance with ASHRAE handbook or in accordance with manufacturer's recommendation.
- 12. \_\_\_\_\_ Air cooled condensers have been selected based on temperature conditions prescribed in the Design Instructions Manual. Adequate space and arrangements for condenser installations shall be referred to prevent cooling air flow from being obstructed or short circuited.
- 13. \_\_\_\_ For package equipment, the unit selected will provide the sensible heat capacity required, especially where the SHF is high. This means that the total unit capacity will probably be considerably greater than the calculated total capacity but that the calculated and scheduled sensible capacity will be the same.
- 14. \_\_\_\_\_ Field and shop fabricated items are adequately detailed as to materials, methods of fabrication and installation. Indicating a hood, for instance, by a rectangle with dimensions only is inadequate to show the Contractor what is to be provided. Showing wall mounted equipment with the note "provide suitable supports" is not acceptable. Details must be shown so that there is no doubt in the mind of the contractor and the Corps' inspectors as to what and how an item is to be installed.
- 15. \_\_\_\_ All items on the drawings are identified, especially for ductwork and piping. Branch dampers shall be shown, and identified in the legend.

- 16. \_\_\_\_\_ Single-line control diagrams and sequence of operations of equipment are provided. Also, that the control scheme shown on the drawings agrees with the specifications and is clearly written using proper English in a manner that is directive in nature relative to the Contractor. Thus the term "shall" is to be used generally in lieu of will". For example: "Pressing the button shall energize the control circuit and …".
- 17. \_\_\_\_ Drain lines required for condensate from cooling equipment and overflow and bleed from cooling towers are shown on the drawings. Also where equipment rooms contain water pumps or possible sources of water drainage on the floors, floor drains should be provided.
- 18. \_\_\_\_ Control panels specified are located on the drawings.
- 19. \_\_\_\_ Electrical duct heaters and controls indicated on the drawings are adequately specified. The main specification for HVAC work contains a paragraph for electric duct heaters.
- 20. \_\_\_\_ Where Government-furnished, contractor-installed items are involved, suitable specifications are included for installation and testing.
- 21. \_\_\_\_ HVAC calculations performed by computers have detailed and explanations and backup for the logic used. Check that the columnar listings of information are properly defined and headed.
- 22. \_\_\_\_ Volume control dampers are provided in all branch ducts for initial balancing and continual maintenance of the HVAC systems.
- 23. \_\_\_\_ Duct mounted smoke detectors are properly located, interlocked with the building fire alarm system and connected to provide the desired control function.
- 24. \_\_\_\_ The complete system control air flow diagram is presented and that major components are shown on the piping and equipment layout drawings. The drawings provide flow diagrams for all systems so that the system logic is immediately obvious.
- 25. \_\_\_\_ Pressure classifications of duct work are shown where required.

26.	 All standby equipment is so noted.
27.	 Isolation valves are provided in all branch lines and at all equipment which will require service.
28.	 Motors and starters are correctly scheduled and coordinated with the electrical characteristics of the system.
29.	 Fire damper and fire door locations as shown on the design drawings coincide with the locations of fire rated separation. In addition fire dampers and fire doors are properly detailed.
30.	 Supply air outlets, return air inlets, etc., have velocities which are below that necessary to achieve the appropriate indoor acoustical design levels.
31.	 Duct velocities are below those required to achieve the appropriate indoor acoustical design levels.
32.	 Return air openings near or close to mechanical rooms, air handling units, etc. have been properly treated with lining and/or attenuators to achieve the appropriate indoor acoustical design levels.
33.	 Water sources and water piping should not be located above (or on the floor above) electrical switch gear or transformer rooms.
34.	 Automatic Vane Control is specified for Vane axial fan applications. Space requirements have been coordinated between Vane axial fan and air flow measuring device manufacturers to assure a satisfactory installation.
35.	 A complete legend and list of abbreviations for HVAC is provided.
36.	 For large district type chilled water systems, verify that chilled water piping manholes are sited to prevent the entrance of ground or surface water and are adequately provided with natural ventilation.
37.	 Review the requirement for water strainers in circulating pump suction lines.
38.	 Review the need for diesel engine exhaust line thermal expansion compensation.

- 39. \_\_\_\_ For POL and district type heating and cooling systems, verify that components are specified with correct pressure ratings and are protected from surge.
- 40. \_\_\_\_ For POL tanks, verify that tank sampling tubes and automatic level indicator tubes are specified or shown as appropriate.
- 41. \_\_\_\_ That the design incorporates seismic requirements based on the seismic zone for the project location.
- 42. \_\_\_\_ For projects in Qatar, design air conditioning systems for indoor temperature of 23 degrees C (73.5 degrees F) to comply with local Qatari requirements.

#### 4. REFRIGERATION

A. GENERAL

#### ITEM NO. CHECK

<u>ITEM</u>

- 1. \_\_\_\_\_ That two-speed unit coolers are not provided unless specifically indicated in the design instructions. The requirement indicated in TM 5-840-1, Cold Storage Facilities, paragraph 14(2) (b), is no longer applicable unless indication is given that the frozen product will arrive at a temperature above 15° F. Where the two speed cooler is to be provided, the two speeds are to be indicated and the unit selected to cool the product at the delivery temperature indicated. Controls should provide the necessary sequencing and include the proper thermostat to control the two speeds.
- 2. \_\_\_\_ That the design incorporates seismic requirements based on the seismic zone for the project location.

#### 5. SPECIAL NOTES

1. \_\_\_\_ That liquid refrigerant receivers are specified to have a charging valve and capacity not less than 25 percent in excess of the system charge. Drawings will often show the charging valve somewhere else on the system and will indicate a specific capacity for the receivers. The designer is not in a position to determine what the system charge is since the type of refrigerant and equipment plus, to a certain extent, the piping arrangement is optional or variable depending on the equipment furnished. If the designer desires to indicate capacity information on the drawing for this item, it should be in the form of "system charge plus 25 percent."

- 2. \_\_\_\_ That minutes of all conferences are reviewed to ensure that all comments have been complied with.
- 3. \_\_\_\_ All applicable preliminary review comments have been incorporated in design document.
- 4. \_\_\_\_ To see the instructions with respect to listing Government-furnished equipment have been complied with.
- 5. <u>Mechanical Design Manuals against design analysis.</u>

# 6. PROPRIETARY MATERIALS AND EQUIPMENT

# INITIAL

To The best of my knowledge, the specifications and drawings do not include any proprietary or sole source materials or equipment except for the following approved items:

#### DESIGN CHECKLIST

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## SECTION 9 – FIRE PROTECTION

ITEM NO.	<u>CHECK</u>	ITEM
1.		Have appropriate criteria been selected and used?
		UFC 3-600-01 Fire Protection Engineering for Facilities
		International Building Code (IBC) Latest Edition
		Life Safety Code (NFPA 101) Latest Edition
		National Fire Protection Association Codes and Standards, Latest Editions
		Other National Codes or Standards
2.		Has a building code analysis been performed?
		Type of construction
		Height and area limitations
		Building separation or exposure protection.

3.		Classification of occupancy determined?
		Per International Building Code
		Per NFPA 101 Life Safety Code
		Identify the various occupancies and hazardous areas associated with the facility
4.		Compliance with UFC 3-600-01 and National Fire Codes.
5.		Requirements for building structural components are properly reflected in design
		Fire-rated walls
		Fire-rated doors
		Fire dampers with their fire-resistive ratings
		Smoke compartmentation
		Smoke barriers
6.		Egress components in accordance with NFPA 101, Life Safety Code?
		Number of Exits
		Remoteness of Exits
		Travel Distance
		Dead End Corridors
		Common Paths of Travel

7.		Analysis of automatic sprinkler systems and suppression systems and protected areas, including hydraulic analysis of required water demand
8.		Fire system appropriately designed?
		Water distribution
		Water storage tanks
		Fire pumps and power supplies
		Location of fire hydrants
9.		Smoke control methods and smoke control systems are appropriately designed.
10.		Fire alarm systems appropriately designed?
		Type of alarm system (direct current; addressable; analog addressable)
		Location of the fire alarm control equipment
		Mass Notification System
		Location of speakers, fire strobes, and Mass Notification Strobes
11.		Fire detection system
		Type of detection system
		Location of detectors
12.		Connection to and description of base fire alarm reporting system

13.		Manual Fire Suppression Systems
		Standpipe systems
		Portable fire extinguishers
14.		Interior finish ratings
15.		Coordination with security and anti-terrorism requirements
16.		Fire Department access
17.		Have waivers and/or performance based values been used in design? Describe below: