



CAWANGAN  
KEJURUTERAAN MEKANIKA

BORANG - AC\_WCP - SKM 2 - 2009


CHECKLIST OF ACCEPTANCE CRITERIA


SERVICES : AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM


PROJECT NAME :


FILE NO. :


**ACCEPTANCE CRITERIA  
FOR INSTALLATION  
OF  
WATER COOLED PACKAGE SYSTEM**


| <br><b>CAWANGAN</b><br><b>KEJURUTERAAN MEKANIKA</b> |   | <b>BORANG - AC - WCP - SKM 2 - 2009</b><br><b>CHECKLIST OF ACCEPTANCE CRITERIA</b><br><b>SERVICES : AIR CONDITIONING &amp; MECHANICAL VENTILATION SYSTEM</b><br><b>PROJECT NAME :</b><br><b>FILE NO. :</b>   |           |              |         |
|---|---|--|-----------|--------------|---------|
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF WATER COOLED PACKAGE UNITS (WCPU)</b>  |   |  |           |              |         |
| NO.   | ITEMS   | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS |
| <b>1</b>  | <b>DRAWINGS &amp; DOCUMENTS</b>   |  |           |              |         |
| a.  | Working drawings  | Provided and approved before the system installation is carried out.<br>Coordination with other disciplines at site (Coordinated drawings).  |           |              |         |
| b.  | Contract document/Copy of : <ul style="list-style-type: none"> <li>• Technical Specification</li> <li>• Design Requirement</li> <li>• Tech. Data of Equip. Offered</li> </ul> | Provided for references.   |           |              |         |
| <b>2</b>  | <b>TECHNICAL CHECKLIST</b>  |  |           |              |         |
| <b>2.1</b>  | <b>WCPU</b>   |  |           |              |         |
| a.  | WCPU no.  |  |           |              |         |
| b.  | Type of WCPU  | Single/Double Skin   |           |              |         |
| c.  | Type of compressor  | Hermetic compressor.   |           |              |         |
| d.  | Physical WCPU appearance :  |  |           |              |         |
|   | • Housing   | Good condition and no dented/crack.  |           |              |         |
|   | • Cooling coils & fins  | Good condition and no dented/crack.  |           |              |         |
| e.  | WCPU Installation   | WCPU install on proper plinth c/w isolator.  |           |              |         |
| f.  | Condenser water pipeworks to WCPU   | Installed c/w bracket support to WCPU in good condition.   |           |              |         |
| g.  | Valves, fittings for pipeworks at WCPU  | Valves fittings such as flowswitch, pressure gauge, balancing valve, flexible joints etc. at the WCPU pipeline in good condition.  |           |              |         |
| h.  | Condensate drain pipe at WCPU   | Installed c/w trap, insulation in good condition and comply to specification.  |           |              |         |
| i.  | Ductworks at WCPU   | Installed c/w insulation in good condition and comply to specification.  |           |              |         |
| j.  | Duct flexible connections   | Provided at location where ductwork joins the AHU.<br>Consist of 2 layers of 567g vapour proof canvas or nylon fabric.   |           |              |         |
| k.  | Filter section <ul style="list-style-type: none"> <li>• Primary filters</li> </ul>  | Provided and can be remove/replace easily.<br>50mm thickness.<br>Additional set of filter supplied for number of filter supplied.  |           |              |         |
|   | <ul style="list-style-type: none"> <li>• Secondary filters (Optional)</li> </ul>  | Provided and can be remove/replace easily.<br>Air tight seal between filter holding frame & housing (approved propriety factory made).<br>Additional set of filter supplied for number of filter supplied.   |           |              |         |
| l.  | Temperature controller for  | Provided and in good condition.  |           |              |         |
| m.  | Starter panel for WCPU  | Provided and in good condition.  |           |              |         |
| n.  | Cable trunking  | Surface & concealed - G.I. conduits<br>Cable trays - perforated hot dipped galvanised.<br>Cable trunking - hot dipped galvanised<br>Size - up to 100mm x 100mm (18 swg)<br>Size - up to 150mm x 150mm (16 swg)<br>Size - larger (not less than 14 swg) |           |              |         |
| <b>NOTES :</b><br>√ - Comply to specification/drawings (Acceptable)<br>X - Not Comply to specification/drawings (Not Acceptable)    |   |  |           |              |         |

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|  |  | SERVICES : AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM  |           |              |         |
|  |  | PROJECT NAME :   |           |              |         |
|  |  | FILE NO. :   |           |              |         |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF COOLING TOWER</b>   |  |  |           |              |         |
| NO.  | ITEMS  | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS |
| <b>1</b>   | <b>DRAWINGS &amp; DOCUMENTS</b>  |  |           |              |         |
| a.   | Working drawings   | Provided and approved before the system installation is carried out.<br>Coordination with other disciplines at site (Coordinated drawings).  |           |              |         |
| b.   | Contract document/Copy of :<br>• Technical Specification<br>• Design Requirement<br>• Tech. Data of Equip. Offered | Provided for references.   |           |              |         |
| <b>2</b>   | <b>TECHNICAL CHECKLIST</b>   |  |           |              |         |
| <b>2.1</b>   | <b>COOLING TOWER (CT)</b>  |  |           |              |         |
| a.   | CT no.   |  |           |              |         |
| b.   | CT type  | Induced Draft Cross Flow type/ Induced Draft Counterflow Type.   |           |              |         |
| c.   | Physical CT appearance   | Casing, louvers, basins, infill etc. in good condition, no dented/crack.   |           |              |         |
| d.   | CT installation  | CT install on proper plinth c/w isolator.<br>No water leakages at water basin joints, pipes etc.   |           |              |         |
| e.   | CT fan   | Multi bladed with fixed or adjustable pitch.<br>Fan blades - heavy duty cast aluminium and housed within a fan cylinder design for streamline air entry.   |           |              |         |
| f.   | Valves fittings for pipeworks at CT  | Valves, fittings such as 3 way motorised valve, gate valve, flexible joints etc. at the CT in good condition.  |           |              |         |
| g.   | Water treatment plant for CT   | Complete package incorporating proportional metering equipment, feed tanks, mixing tanks and other accessories.<br>Installed and commissioned strictly in accordance to the manufacturer's instruction.  |           |              |         |
| h.   | Service ladder for CT  | Stainless steel type.<br>CT height > than 1.5m.  |           |              |         |
| i.   | Service platform   | Provided if > one CT installed.<br>Interconnected in adjacent to the CT arrangement.   |           |              |         |
| j.   | Cable trunking   | Surface & concealed - G.I. conduits<br>Cable trays - perforated hot dipped galvanised.<br>Cable trunking - hot dipped galvanised<br>Size - up to 100mm x 100mm (18 swg)<br>Size - up to 150mm x 150mm (16 swg)<br>Size - larger (not less than 14 swg) |           |              |         |
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|   |   | PROJECT NAME :   |           |              |         |
|   |   | FILE NO. :   |           |              |         |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF CONDENSER WATER PUMP (CWP)</b>   |   |  |           |              |         |
| NO.   | ITEMS   | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS |
| <b>1</b>  | <b>DRAWINGS &amp; DOCUMENTS</b>   |  |           |              |         |
| a.  | Working drawings  | Provided and approved before the system installation is carried out.<br>Coordination with other disciplines at site (Coordinated drawings).  |           |              |         |
| b.  | Contract document/Copy of : <ul style="list-style-type: none"> <li>• Technical Specification</li> <li>• Design Requirement</li> <li>• Tech. Data of Equip. Offered</li> </ul> | Provided for references.   |           |              |         |
| <b>2</b>  | <b>TECHNICAL CHECKLIST</b>  |  |           |              |         |
| <b>2.1</b>  | <b>CWP</b>  |  |           |              |         |
| a.  | CWP no.   |  |           |              |         |
| b.  | CWP Installation  | CWP & driver installed on on a fabricated steel base plate.<br>CWP & driver alignment in good operating condition.   |           |              |         |
| c.  | Chilled water pipeworks to CWP  | Installed c/w steel bracket support to CWP in good condition.  |           |              |         |
| d.  | Valves, fittings for pipeworks at CWP   | Valves, fittings such as flexible connector, strainer, isolating valve, check valve, pressure gauge, thermometer etc. at the CWP pipeline in good operating condition.   |           |              |         |
| e.  | Cable trunking  | Surface & concealed - G.I. conduits<br>Cable trays - perforated hot dipped galvanised.<br>Cable trunking - hot dipped galvanised<br>Size - up to 100mm x 100mm (18 swg)<br>Size - up to 150mm x 150mm (16 swg)<br>Size - larger (not less than 14 swg) |           |              |         |
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|   |  | PROJECT NAME :  |                  |                     |                |
|   |  | FILE NO. :  |                  |                     |                |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF MAKE UP WATER TANK</b>   |  |   |                  |                     |                |
| <b>NO.</b>  | <b>ITEMS</b>   | <b>CRITERIA</b>   | <b>(√) / (X)</b> | <b>DATE/INITIAL</b> | <b>REMARKS</b> |
| <b>1</b>  | <b>DRAWINGS &amp; DOCUMENTS</b>  |   |                  |                     |                |
| a.  | Working drawings   | Provided and approved before the system installation is carried out.<br>Coordination with other disciplines at site (Coordinated drawings).   |                  |                     |                |
| b.  | Contract document/Copy of :<br>• Technical Specification<br>• Design Requirement<br>• Tech. Data of Equip. Offered | Provided for references.  |                  |                     |                |
| <b>2</b>  | <b>TECHNICAL CHECKLIST</b>   |   |                  |                     |                |
| <b>2.1</b>  | <b>Make Up Water Tank</b>  |   |                  |                     |                |
| a.  | Tank material  | Hot-dip galvanized pressed steel treated with anti- rust coating.   |                  |                     |                |
| b.  | Tank Installation  | Water tank mounted complete with steel skid base (I-Beams) on concrete plinths.<br>Tank installed complete with level indicators of the float type, external and internal access ladders of hot-dip galvanized steel, vent pipe complete with mosquito net, scour pipe complete with drain valve.<br>Level of water tank higher than Cooling Tower.<br>No water leakages at any water tank joints, pipes etc. |                  |                     |                |
| c.  | Incoming water supply  | Provided c/w gate valve and high pressure float valve.  |                  |                     |                |
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|   |  | FILE NO. :   |           |              |  |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF PIPEWORKS</b>  |  |  |           |              |  |
| NO.   | ITEMS  | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS  |
| <b>1</b>  | <b>DRAWINGS &amp; DOCUMENTS</b>  |  |           |              |  |
| a.  | Working drawings   | Provided and approved before the system installation is carried out.<br>Coordination with other disciplines at site (Coordinated drawings).  |           |              |  |
| b.  | Contract document/Copy of :<br>• Technical Specification<br>• Design Requirement<br>• Tech. Data of Equip. Offered | Provided for references.   |           |              |  |
| <b>2</b>  | <b>TECHNICAL CHECKLIST</b>   |  |           |              |  |
| <b>2.1</b>  | <b>PIPEWORKS</b>   |  |           |              |  |
| <b>A.</b>   | <b>Chilled/Condenser Water Pipes</b>   |  |           |              |  |
| a.  | Pipe material  | Galvanised iron heavy grade Class C pipes to BS EN 10255:2004.   |           |              |  |
| b.  | Pipe installation & welding works  | Carried out by competent person.<br>Competent welder certificate provided.   |           |              |  |
| c.  | Straight vertical run pipe of more than 30m length   | Have dirt pockets formed from equal tee and plugs at low point of risers.  |           |              |  |
| d.  | Pipeworks in all plantrooms  | Installed with flanges and/or union dependant in pipe size at intervals not exceeding 6m.  |           |              | To facilitate repair or dismantling.                           |
| e.  | After pipelines installed  | All opening capped or plugged, and left in place until removal is necessary for completion of installation.<br>Piping flushed or blown clean and strainers or line pockets cleared from foreign materials before putting pipelines into service.<br>Piping thoroughly cleaned and free from scale by wire brushing.  |           |              | To prevent entrance of materials that would obstruct the pipe. |
| f.  | Pipe clearance   | Approximately 50mm left between outlet of pipe or insulation and the nearest wall, ceiling or equipment surface.   |           |              |  |
| g.  | <b>Pipe insulation</b>   |  |           |              |  |
| i.  | Chilled water pipes  | Factory fabricated pre-insulated pipes.<br>Field insulation only allowed for valves, flanges and other pipeline fittings and this shall carried out in accordance to the manufacturer's instruction.<br>Personnel conducting field insulation must be authorized by the manufacturer.<br>Letter of Authorization from manufacturer with personnel names must clearly spelled out before any of field insulation work is to be carried out.<br>Combined insulation of two or more pipes shall not be approved.<br>Pre-insulated pipes must have ends suitably prepared to accept welded joints. |           |              |  |
|   |  | Samples of insulating material and workmanship submitted to the S.O. for approval before proceeding with the installation work.  |           |              |  |

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|  |                                  | <b>CHECKLIST OF ACCEPTANCE CRITERIA</b>  |           |              |                                 |
|  |                                  | SERVICES : AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM  |           |              |                                 |
|  |                                  | PROJECT NAME :   |           |              |                                 |
|  |                                  | FILE NO. :   |           |              |                                 |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF PIPEWORKS</b>   |                                  |  |           |              |                                 |
| NO.  | ITEMS                            | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS                         |
| h.   | Pipe jacket material             | <b>Above ground</b> - the outer casing (jacketing) shall be a spiral formed lock seamed galvanized iron type of SWG 26 gauges (0.5 mm).  |           |              |                                 |
|  |                                  | The surface painted with an approved rust inhibitive primer and two (2) high gloss-finishing coats to approved colors and to the approval of the S.O.  |           |              |                                 |
|  |                                  | <b>Buried/underground</b> - Jacket material for chilled water pipes shall be high density polyethylene (HDPE) tube conforming to approved standard.  |           |              |                                 |
| i.   | Underground pipe characteristics | Galvanized iron to BS EN 10255:2004 Class 'C', factory wrapped externally with bituminous comply to BS 534:1990.   |           |              |                                 |
|  |                                  | Complete with pipes pierce through floors, ceilings or walls.  |           |              |                                 |
|  |                                  | <b>Laid at least 900 mm below the surface and adequate provision for protection against vehicle movements and corrosion shall be taken.</b>  |           |              |                                 |
|  |                                  | <b>Insulated pipe laid on a sand bed completely free of stones, back-filled with sand around and over the pipe to a minimum depth of 80 mm.</b>  |           |              |                                 |
|  |                                  | Next layer of backfill shall then be 300 mm deep of material free of stones. The trench shall then be filled with available material   |           |              |                                 |
| <b>B. Condensate Drain Pipes</b>   |                                  |  |           |              |                                 |
| a.   | Condensate drain pipes           | PVC Class C for all sizes.   |           |              |                                 |
|  |                                  | Insulated with 25 mm thick Armaflex or flexible expanded rubber compound.  |           |              |                                 |
| <b>C. Fill Pipes</b>   |                                  |  |           |              |                                 |
| a.   | Fill pipes                       | Same material with the pipe it connected.  |           |              | Size of pipe shall be approved. |
| <b>Refrigerant Pipes</b>   |                                  |  |           |              |                                 |
| a.   | Refrigerant pipes material       | Hard drawn seamless copper refrigerant pipes with copper fittings and silver soldered joints.  |           |              |                                 |
|  |                                  | Properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports.   |           |              |                                 |
|  |                                  | For refrigerant piping above 80mm O.D, it may be constructed from extra heavy quality black iron steam pipes with welded joints, in lieu of hard drawn copper refrigerant pipes.                     |           |              |                                 |
| b.   | Refrigerant pipes insulation     | Whole of the liquid and suction refrigerant lines including fittings, valves and strainer bodies, flanges, etc. insulated with 50 mm thick Armaflex expanded rubber compound or approved equivalent. |           |              |                                 |



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|------------|---|--|-----------|--------------|--|
| <b>2.2</b> | <b>PIPE FLANGES</b>                             |  |           |              |  |
| a.         | Flanges   | <p>Provided at each piping connection of equipment, valves or strainers.</p> <p>Weld neck type.</p> <p>Mating faces for each connection must be compatible.</p> <p>Bolt holes in perfect alignment.</p>  |           |              |  |
| <b>2.3</b> | <b>PIPE SLEEVES</b>                             |  |           |              |  |
| a.         | Pipe sleeves                                    | <p>One nominal diameter larger than the service pipe, except for sizes 100mm and above.</p> <p>Fitted for pipes passing through floors, walls or partitions.</p> <p>Galvanised pipe off-cuts for galvanised or black iron pipe.</p> <p>Brass or copper for copper pipe.</p> <p>Fitted in floors generally end 12mm above finished floor level for general areas.</p> <p>Fitted in floors generally end 50mm above finished floor level for plant rooms and wet floor areas, tightly caulked with suitable diameter asbestos rope.</p> <p>Pipe pass through fire break walls/partitions, clearance between pipes or insulation and sleeves tightly pegged with suitable diameter asbestos rope.</p> |           |              | To form sound and fire barrier.                                  |
| <b>2.4</b> | <b>EXPANSION JOINTS AND ANCHORS</b>             |  |           |              |  |
| a.         | Expansion joints                                | <p>Provided in any straight arm of chilled and condenser water piping over 60m length.</p> <p>Guided bellow type.</p>  |           |              |  |
| b.         | Pipe spacing and anchoring                      | Refer specification.   |           |              | To control movement of pipes due to thermal and pressure gauges. |
| <b>2.5</b> | <b>PIPE FITTINGS</b>                            |  |           |              |  |
| a.         | Pipe fittings                                   | <p>Cast iron or cast/forged steel.</p> <p>Standard pieces used throughout the whole installation.</p>  |           |              |  |
| b.         | Screwed joints sealing compound                 | Litharge or glycerin.  |           |              |  |
| c.         | Pipe jointings                                  | <p>Joints up to and including <b>65 mm (2½")</b> diameter on black steel piping made by means of <b>screwed or welded connections.</b></p> <p>Joints up to and including <b>65 mm (2½")</b> diameter on galvanized steel piping made by means of <b>screwed connections.</b></p>   |           |              |  |
| <b>2.6</b> | <b>PIPE HANGERS &amp; SUPPORTS</b>              |  |           |              |  |
| a.         | Hangers & support                               | Rigid construction and properly isolated.  |           |              | To prevent noise & vibration.                                    |
| b.         | Hangers & support intervals :                   |  |           |              |  |
|            | i. Up to and including 50 mm (2" diameter) bore | <p>• 3.0 m apart (Horizontal spacing)</p> <p>• 3.5 m apart (Vertical spacing)</p>  |           |              |  |





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ACCEPTANCE CRITERIA FOR INSTALLATION OF PIPEWORKS


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|-----|--|---|-----------|--------------|---------|
|     | i. 65mm bore up to and p to and including 50 mm (2" diameter) bore | • 4.0 m apart (Horizontal spacing)  |           |              |         |
|     |  | • 4.0 m apart (Verticle spacing)  |           |              |         |
|     |  | Installed at not more than 10 diameters from each change in direction of pipework (max.1.2m)  |           |              |         |
| b.  | Hangers for copper pipelines                                       | Not more than half of intervals of steel pipe.  |           |              |         |
| c.  | Fixing pipe hangers or bracket to building structure               | Approved metal expansion plugs/raw plugs.   |           |              |         |
| d.  | Insulated chilled water, refrigerant lines                         | Protected by metal bearing plate curved to match the insulation.  |           |              |         |
|     |  | Where supports are fastened around insulation, heavy density insulation or approved type saddles shall be placed between pipe work and supports and moulded into adjacent insulation in an approved manner. |           |              |         |
| e.  | 150mm diameter pipe or below                                       | Hung on hangers from the ceiling slab above.  |           |              |         |
| f.  | Cradles for pipes 150mm diameter or larger and clamps for          | Support pipe independent from any lagging.  |           |              |         |
| g.  | Horizontal runs of pipe hangers                                    | Allow for expansion of pipelines.   |           |              |         |
|     |  | Provision made for adjusting gradients and alignments.  |           |              |         |
|     |  | Split ring & adjustable type or other approved design hung on around steel rods.  |           |              |         |
| h.  | Vertical runs of pipe hangers                                      | Supported by clamps or collars supported from angles or channels in turn resting on spring supports fixed to floor slab.  |           |              |         |
|     |  | Support provided at each alternate floor slab.  |           |              |         |


NOTES :

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|   |  | FILE NO. :   |           |              |         |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF DUCTWORKS</b>  |  |  |           |              |         |
| NO.   | ITEMS  | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS |
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| b.  | Contract document/Copy of :<br>• Technical Specification<br>• Design Requirement<br>• Tech. Data of Equip. Offered | Provided for references.   |           |              |         |
| <b>2</b>  | <b>TECHNICAL CHECKLIST</b>   |  |           |              |         |
| <b>A.</b>   | <b>DUCTWORK (RIGID)</b>  |  |           |              |         |
| a.  | Ductwork (Rigid duct)  | Galvanised steel sheets<br>No patched or make up pieced ductwork is allowed.   |           |              |         |
|   | Gauge of sheet metal   | Refer Technical Specification.   |           |              |         |
|   | Flexible connections for rigid duct  | Provided where the ductwork joins the air handling unit or fan housing.<br>Consist of two layers of 567g (20 oz) vapour proof canvas or nylon fabric   |           |              |         |
| b.  | <b>External insulation of ducts</b>  |  |           |              |         |
|   | i. Fibreglass Insulation   | Generally, supply and return air ductwork insulated externally with 50 mm fibreglass.<br>Ductwork in ceiling space immediately below the roof and in the vertical duct shaft insulated with 50 mm thick fibreglass insulation.   |           |              |         |
|   | ii. Polyurethane (P.U) Insulation  | All ducts exposed to unconditioned space and in the plantroom shall be insulated with 50 mm thick fire-retardant type P.U.   |           |              |         |
|   | iii. Polyethelyne (P.E) Insulation   | Generally, supply and return air ducts insulated with 7.0 mm thick PE foam.<br>Ductworks below the roof or in any vertical shaft have 10.0mm thick PE foam. Ductworks within the plant room and conditioned air ducts exposed to weather insulated with PE foam reinforced with galvanised wire mesh and finished with hybrid plaster. |           |              |         |
| c.  | <b>Internal insulation of ducts</b>  |  |           |              |         |
|   | i. Fibreglass Insulation   | Main supply air duct immediately after the centrifugal fan shall be internally insulated with 50 mm thick fibreglass, faced over with 1 mm thick perforated galvanised steel sheet.  |           |              |         |
|   | ii. Polyethelyne (P.E) Insulation  | Main supply air duct immediately after the centrifugal fan shall be internally insulated with 12 mm thick PE.  |           |              |         |
|   | iii. Polyurethane (P.U) Insulation   | Main supply air duct immediately after the centrifugal fan shall be internally insulated with 25 mm thick PU.  |           |              |         |

| <br><b>CAWANGAN</b><br><b>KEJURUTERAAN MEKANIKA</b> |                                  | <b>BORANG - AC_WCP - SKM 2 - 2009</b>   |           |              |         |
|---|----------------------------------|---|-----------|--------------|---------|
|   |                                  | <b>CHECKLIST OF ACCEPTANCE CRITERIA</b>   |           |              |         |
|   |                                  | SERVICES : AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM   |           |              |         |
|   |                                  | PROJECT NAME :  |           |              |         |
|   |                                  | FILE NO. :  |           |              |         |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF DUCTWORKS</b>  |                                  |   |           |              |         |
| NO.   | ITEMS                            | CRITERIA  | (√) / (X) | DATE/INITIAL | REMARKS |
| <b>B.</b>   | <b>FLEXIBLE DUCTS</b>            |   |           |              |         |
| a.  | Flexible ducts                   | <p>Allowed for connection with branch duct to diffuser/grille.</p> <p>Maximum length shall be not more than 2.0 meters from branch duct.</p> <p>Constructed of double thickness aluminium foil fitted and glued around a core of helically wound zinc-coated high carbon spring steel wire.</p> <p>Alternatively, manufactured from roll strip aluminium constructed with lock seam to form a continuous flexible spiral duct.</p>  |           |              |         |
| b.  | Flexible ductwork insulation     | <p>Insulation shall be of 50mm thick fibreglass.</p> <p>Density = 32 kg/m3.</p> <p>Faced outside with approved vapour barrier and fitted around the flexible duct.</p> <p>All flexible ductwork to diffusers shall be insulated.</p>  |           |              |         |
| c.  | Flexible ductwork connection     | <p>Each spigot on rigid ducts for connection to flexible ducts leading to single air outlets shall be standard circular or equivalent oval shape with butterfly type volume control dampers fitted.</p> <p>Flexible duct connections and connections to spigots made using factory fitted male metal end collars and quick acting clamp locks, and each joint shall be made airtight.</p> <p>Ducts installed without restriction to airflow and supported where suspended above the ceiling by 38mm wide straps at not more than 1 meter spacing.</p> |           |              |         |
| <b>C.</b>   | <b>FIRE RATED DUCTWORK</b>       |   |           |              |         |
| a.  | Fire Rated Ductwork              | <p>Minimum of 2 hours fire rating.</p> <p>Encased with a framework of formed metal support channels and furring channels of sizes and at spacings recommended by the supplier of the fire rated construction.</p>   |           |              |         |
|   | Fire Rated Ductwork construction | <p>50 mm (2") layer of ceramic type spray applied over the walls of the duct or plenum.</p> <p>An expanded metal lath shall be attached to the furring channels.</p> <p>A second coat of ceramic type spray shall be applied to give a minimum overall thickness of 75 mm (3") spray.</p> <p>The exposed sides of the duct or plenum shall then be sheathed with 0.8 mm galvanised steel fixed as specified for externally insulated duct sheathing.</p>  |           |              |         |

| <br><b>CAWANGAN</b><br><b>KEJURUTERAAN MEKANIKA</b>  |   | <b>BORANG - AC_WCP - SKM 2 - 2009</b>  |           |              |         |
|--|---|--|-----------|--------------|---------|
|  |   | <b>CHECKLIST OF ACCEPTANCE CRITERIA</b>  |           |              |         |
|  |   | SERVICES : AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM  |           |              |         |
|  |   | PROJECT NAME :   |           |              |         |
|  |   | FILE NO. :   |           |              |         |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF DUCTWORKS</b>   |   |  |           |              |         |
| NO.  | ITEMS                                     | CRITERIA   | (√) / (X) | DATE/INITIAL | REMARKS |
| D.   | <b>SUPPORT &amp; HANGERS (RIGID DUCT)</b> |  |           |              |         |
| a.   | Supports and Hangers (Rigid duct)         | Rigid ductwork shall be supported at centers not greater than 2 meters apart and anchored to the building structure.   |           |              |         |
|  |   | Duct supports consist of 38 mm (1 1/2") mild steel angle bearers with 9.5 mm (3/8") diameter mild steel rods or 25 mm x 3 mm (1" x 1/8") mild steel strips as hangers. |           |              |         |
|  |   | <b>Direct fastening of duct to support with screws is not allowed.</b>   |           |              |         |
|  |   | Duct hangers fixed to the concrete with anchor bolt. <b>Wooden and plastic plugs are not allowed.</b>  |           |              |         |
| e.   | Elbows and Turning Vanes                  | All elbows have a minimum inside radius equal to the width of the duct where possible.   |           |              |         |
|  |   | Where space does not permit such radius, sharper or right angle bends may be used together with double thickness aerofoil shape turning vanes.                         |           |              |         |
|  |   | Turning vanes must be securely fitted to the elbows.   |           |              |         |
| <b>NOTES :</b><br><br>√ - Comply to specification/drawings (Acceptable)<br>X - Not Comply to specification/drawings (Not Acceptable) |   |  |           |              |         |

| <br><b>CAWANGAN<br/>KEJURUTERAAN MEKANIKA</b>    |  | <b>BORANG - AC_WCP - SKM 2 - 2009</b>                       |  |              |         |
|--|--|---|--|--------------|---------|
|  |  | <b>CHECKLIST OF ACCEPTANCE CRITERIA</b>                     |  |              |         |
|  |  | SERVICES : AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM |  |              |         |
|  |  | PROJECT NAME :  |  |              |         |
|  |  | FILE NO. :  |  |              |         |
| <b>ACCEPTANCE CRITERIA FOR INSTALLATION OF WATER COOLED PACKAGE SYSTEM</b>   |  |   |  |              |         |
| NO.  | ITEMS  | CRITERIA  | (√) / (X)  | DATE/INITIAL | REMARKS |
| <b>1</b>   | <b>DRAWINGS &amp; DOCUMENTS</b>  |   |  |              |         |
| a.   | Working drawings   | Acceptable/Not Acceptable                                   |  |              |         |
| b.   | Contract document/Copy of :<br>• Technical Specification<br>• Design Requirement<br>• Tech. Data of Equip. Offered | Acceptable/Not Acceptable                                   |  |              |         |
| <b>2</b>   | <b>TECHNICAL CHECKLIST</b>   |   |  |              |         |
| 2.1  | Water Cooled Package Units   | Acceptable/Not Acceptable                                   |  |              |         |
| 2.2  | Cooling Tower  | Acceptable/Not Acceptable                                   |  |              |         |
| 2.3  | Condenser Water Pump   | Acceptable/Not Acceptable                                   |  |              |         |
| 2.4  | Make Up Water Tank   | Acceptable/Not Acceptable                                   |  |              |         |
| 2.5  | Pipeworks  | Acceptable/Not Acceptable                                   |  |              |         |
| 2.6  | Fixed Ductwork   | Acceptable/Not Acceptable                                   |  |              |         |
| 2.7  | Flexible Ducts   | Acceptable/Not Acceptable                                   |  |              |         |
| 2.8  | Fire Rated Ducts   | Acceptable/Not Acceptable                                   |  |              |         |
| 2.9  | Diffusers, Registers, Grilles & Dampers  | Acceptable/Not Acceptable                                   |  |              |         |
| <b>NOTES :</b><br>√ - Comply to specification/drawings (Acceptable)<br>X - Not Comply to specification/drawings (Not Acceptable) |  |   |  |              |         |
| <b>REMARKS/COMMENTS :</b>  |  |   |  |              |         |
| Inspected by :<br><br>.....<br>Name :<br>Designation :<br>Date:  |  |   | Verified by :<br><br>.....<br>Name :<br>Designation :<br>Date: |              |         |