Article 7 and 9 Table 1

The Best Available Techniques Which Shall Be Applied in Utility Systems and Equipment

Utility technology items shall comply with the following contents of the Best Available Techniques.

I. Combustion handling systems

Item
1. Lignite pre-drying
2. Coal gasification
3. Fuel drying
4. Biomass gasification
5. Bark pressing
6. Expansion turbine to recover the energy content of pressurized gases
7. Advanced computerised control of combustion conditions for emission reduction and boiler performance
8. Using flue-gas heat to supply district heating system
9. Reducing excess air and make it reach the optimum air-fuel ratio
10. Properly reducing the exhaust temperature to reduce heat loss
11. Reducing the concentration of carbon monoxide in the exhaust gas and improving boiler efficiency
12. Heat accumulation
13. Cooling tower discharge
14. Different techniques for the cooling system
15. Using waste heat to preheat gas fuels to improve thermal efficiency
16. Preheating combustion air to improve fuel efficiency
17. Installing recuperative or regenerative burners to recover burner waste heat
18. Controlling and optimizing combustion conditions by monitoring fuel, air flow rates, and oxygen content in flue gas
19. Fuel choice
20. Using oxygen-enriched combustion technology to improve energy efficiency
21. Reducing heat loss by insulation
22. Reducing heat loss caused by frequent opening and closing or poor sealing of furnace doors
23. Fluidised bed combustion

II. Heat recovery systems

Item
1. Monitoring the efficiency periodically
2. Preventing or removing the internal scaling and external dust accumulation of equipment

III. Steam handling systems

Item
1. Energy efficient design and installation of steam distribution pipework
2. Throttling devices and the use of backpressure turbines: utilize backpressure turbines

instead of PRVs
3. Improve operating procedures and boiler controls
4. Use sequential boiler controls (apply only to sites with more than one boiler)
5. Install flue-gas isolation dampers (applicable only to sites with more than one boiler)
6. For feed water preheating, the following methods are available: (1)process waste heat recovery (2)recovery of heat energy from combustion air by economizer (3)heating condensate with deoxygenated feed water (4)using heat exchangers to condense the steam used for degassing and feed water heating
7. Prevention and removal of scale deposits on heat transfer surfaces. (Clean boiler heat transfer surfaces)
8. Boiler blowdown is reduced by improving the water treatment system and installing automatic dissolved solids control equipment
9. It is necessary to check and attach/repair the boiler refractory material during regular inspection
10. Maintaining optimal discharge rate of degassers
11. Minimise boiler short cycling losses
12. Carrying out boiler maintenance
13. Optimizing the steam distribution system
14. Isolate steam from unused lines
15. Regularly inspecting and confirming the heat insulation of steam pipes and condensate return pipes. (Confirming the proper heat insulation of the pipes, pipe fittings, valve bodies, and tanks)
16. Implement a control and repair programme for steam traps
17. Collect and return condensate to the boiler for re-use. (Optimise condensate recovery)
18. Re-use of flash-steam. (Use high pressure condensate to make low pressure steam)
19. Recover energy from boiler blowdown
20. Expansion turbine to recover the energy content of pressurised gases
21. Change turbine blades when repairing
22. Using advanced materials to meet high steam parameter requirements to improve efficiency
23. Supercritical steam parameters
24. Double reheat
25. Regenerative feed-water
26. Use of heat content of the flue-gas for district heating
27. Heat accumulation
28. Advanced computerised control of the gas turbine and subsequent recovery boilers

IV. Electric power supply systems

Item
1. Installing capacitors in the AC circuits to decrease the magnitude of reactive power
2. Minimising the operation of idling or lightly loaded motors
3. Avoiding the operation of equipment above its rated voltage
4. When a new or replacement motor is installed, a high efficiency motor (≥ IE3) should be used

5. Ensure power cables have the correct dimensions for the power demand
6. Keep online transformer(s) operating at a load above 40 ~50 % of the rated power
7. Use high efficiency/low loss transformers
8. Place equipment with a high current demand as close as possible to the power source (e.g. transformer)

V. Electric motor drive subsystems

Item
1. Using efficient motors (EEMs) (≥ IE3)
2. Proper motor sizing
3. Installing high efficiency transmission/reducers
4. Use: direct coupling where possible, synchronous belts or cogged V-belts in place of V belts, helical gears in place of worm gears
5. Rewinding: avoid rewinding and replace with an EEM, or use a certified rewinding contractor (EEMR)
6. Power quality control
7. Lubrication, adjustments, tuning

VI. Air compressor systems

Item
1. Overall system design, including multi-pressure systems
2. Improve cooling, drying and filtering
3. Reduce frictional pressure loss (for example by increasing pipe diameter)
4. Improvement of drives (high efficiency motors)
5. Improvement of drives (speed controller)
6. Use of sophisticated control systems
7. Recover waste heat for use in other functions
8. Use external cool air as intake
9. Storage of compressed air near highly-fluctuating uses
10. Optimise certain end use devices
11. Reduce compressed air leaks
12. More frequent filter replacement
13. Optimise working pressure

VII. Pump systems

Item
1. Avoid oversizing when selecting pumps and replace oversized pumps
2. Match the correct choice of pump to the correct motor for the duty
3. Design of pipework system
4. Control and regulation system
5. Shut down unnecessary pumps
6. Use of variable speed drives (VSDs)
7. Using multiple pumps (number of units under control)
8. Regular maintenance. Where unplanned maintenance becomes excessive, check for: cavitation, wear, wrong type of pump
9. Minimise the number of valves and bends commensurate with keeping ease of operation and maintenance
10. Avoid using too many bends (especially tight bends)
11. Ensuring the pipework diameter is not too small (correct pipework diameter)

VIII. Heating, ventilation, and air conditioning systems

Item
1. Overall system design. Identify and equip areas separately for (1)general ventilation (2)specific ventilation (3)process ventilation
2. Optimise the number, shape, and size of intakes
3. Use fans： (1)of high efficiency (2)designed to operate at optimal rate
4. Managing the airflow, including the consideration of dual ventilation systems (indoor and outdoor ventilation and heat exchange)
5. Air system design： (1)ducts are of a sufficient size (2)circular ducts (3)avoid long runs and obstacles such as bends, narrow sections
6. Optimise electric motors, and consider installing a VSD
7. Use automatic control systems. Integrate with centralised technical management systems
8. Integration of air filters into air duct system and heat recovery from exhaust air (heat exchangers)
9. Reduce heating/cooling needs by： (1)building insulation (2)energy-efficient glazing (3)air infiltration reduction (4)automatic closure of doors (5)destratification (6)lowering of temperature set point during non-production period (programmable regulation) (7)reduction of the set point for heating and raising it for cooling
10. Improve the efficiency of heating systems through： (1)recovery or use of wasted heat (2)heat pumps (3)radiative and local heating systems coupled with reduced temperature set points in the non-occupied areas of the buildings
11. Improve the efficiency of cooling systems through the use of free cooling

IX. Lighting systems

Item
1. Determining the lighting requirements based on the illuminance and spectral content (color temperature and color rendition) required by the predetermined task
2. Plan space and activities in order to optimise the use of natural light
3. Selection of fixtures and lamps according to specific requirements for the intended use
4. Use of lighting management control systems, including occupancy sensors, timers, etc.
5. Train building occupants to utilise lighting equipment in the most efficient manner

X. Drying, separation and concentration processing systems

Item

1. Selecting the best separation technology or a combination of the following separation technologies to satisfy specific process equipment
2. Use of surplus heat from other processes
3. Use a combination of techniques
4. Mechanical processes, e.g. filtration, membrane filtration
5. Heat drying method: (1)directly heated dryers (2)indirectly heated dryers (3)using multiple effect
6. Superheated steam
7. Heat recovery (including MVR and heat pumps)
8. Optimise insulation of the drying system
9. Radiation processes
10. Process automation in thermal drying processes

XI. Industrial cooling systems

Item
1. The overall system is designed based on the requirements of the manufacturing process and factory and is categorized as: (1)closed type (2)open type
2. For the BAT of the design phase of the industrial cooling systems, the lowest energy consumption is achieved by the following combinations: (1)reducing pressure loss in water flow and airflow (2)adopting high efficiency and low energy consumption equipment (3)reducing the number of energy-demanding equipment (4)applying optimized cooling water treatment in water-cooled cooling systems to keep the heat transfer surfaces clean and avoid scaling, rusting, fouling, etc., so that in each individual case, the lowest energy consuming combination of the above factors must be achieved to operate the industrial cooling systems
3. The methods to reduce direct energy consumption are provided as follows. Fans or pumps: (1)matching motors with high efficiency (2)designing for optimum pressure loss and flow rate (3)using speed variators
4. Operating the industrial cooling systems according to process requirements: (1)water supply pressure (2)backwater pressure (3)temperature of water supply (4)temperature difference between the water supply and back water (5)pump efficiency (6)fan motor efficiency (7)point-of-use pressure requirements