

DIRECTORATE OF STEAM BOILERS
(MAHARASHTRA STATE)
EXAMINATION FOR CERTIFICATE OF PROFICIENCY
AS A BOILER OPERATION ENGINEER

(Under the Boiler Operation Rules, 2021)

Boiler Technology - I

8th March 2025

(TIME : 10-00 A.M. TO 1-00 P.M.)

(Max. Marks—100)

Instructions to Candidates:—

- (1) Attempt any **five** questions.
- (2) Question No. 1 is **Compulsory**.
- (3) All questions carry **equal** Marks.
- (4) Answer in brief and to the correct point will attract **Full** Marks.
- (5) Draw neat sketches wherever **necessary** for correct explanations.
- (6) Figure to the right indicates **Full** Marks.
- (7) Assume suitably missing data, if **any**.

- | | Marks |
|---|--------------|
| 1. (A) Choose the correct options from the following :— | (10 X 1) |
| (1) Bed coil tubes of a fluidized combustion boiler are studded | |
| (a) To increase heat transfer (b) To minimize erosion of tubes. | |
| (c) Both A and B. | |
| (2) Registry number of boiler is T / 5658, the 'T' in the number indicates that it is a | |
| (a) Tower type boiler (b) Triple pass boiler | |
| (c) Tubular boiler (d) None of the above. | |
| (3) Which loss is not considered while evaluating the boiler efficiency by indirect method? | |
| (a) Blow down loss (b) Unburnt loss | |
| (c) Air infiltration loss (d) Stack temperature loss. | |
| (4) In once-through boiler | |
| (a) Flue gases pass only in one direction. (b) Steam is sent out only in one direction. | |
| (c) Air is sent through same direction. (d) There is no recirculation of water. | |
| (5) High % of carbonmonoxide presence in the flue gases of boiler is an indicator of | |
| (a) High excess air (b) Complete combustion | |
| (c) Good control of pollutants (d) Low excess air. | |
| (6) The rise in conductivity of boiler feed water indicates | |
| (a) Rise in the TDS of feed water. (b) Alkalinity of water | |
| (c) Drop in the TDS of feed water. (d) Thermal conductivity of water. | |

[Turn over

4. (a) What are different Bi products of sugar industry and its use. (4)
- (b) Discuss operational problems of spent wash fired boiler in sugar Industry. (5)
- (c) What is meant by NPSH and its effects on boiler feed pump. (5)
- (d) A steam pipeline of 100 mm outer diameter is not insulated for 100 meters and supplying steam at 10 kg/cm². Find out the annual fuel savings if the line is properly insulated with 65 mm insulation material. Assume 7000 hours/year of operation. (6)

Given:

Boiler efficiency	:	85%
Fuel Oil cost	:	Rs. 32,000/tonne
Calorific Value of fuel oil	:	10,300 KCal/kg
Surface temperature without insulation.	:	180 °C
Surface temperature after insulation.	:	75 °C
Ambient temperature.	:	30 °C

5. (a) Why spiral wall design is adopted in super critical boiler ? Why transition header is required in this case ? (4)
- (b) Why deaeration of feed water is required? Explain the working of Deaerator. (5)
- (c) Describe ion exchange process in demineralization plant (DM). How does it remove dissolved salts and what are some common challenges in the system maintenance? (5)
- (d) A plant proposes to install an air pre-heater to pre-heat combustion air from 30° C to 160° C in the existing boiler. The other performance parameters of the boiler plant are as given below: - (6)

Fuel used	:	Bio-mass
Bio-mass firing rate	:	28TPH
Sulfur in fuel	:	0.1%
GCV of fuel	:	2300 kCal/kg
Boiler efficiency	:	70%
Flue gas temperature	:	300 °C
Air requirement	:	4.5 kg/kg of fuel
Specific heat of combustion air	:	0.24 kCal/kg °C
Specific heat of flue gas	:	0.23 kCal/kg °C

Estimate the following: -

1. The quantity of flue gas assuming no ash content in the fuel.
2. Heat transferred to the combustion air after installation of air preheater.
3. Exit flue gas temperature after installation of an air pre-heater and whether it is acceptable?

[Turn over

6. Write short notes (any *four*)

- (a) Departure from Nucleate Boiling.
 - (b) RLA study of Boiler – Objective, Methodology and Benefits.
 - (c) Materials for various pressure parts of water tube boiler.
 - (d) Three elements Drum Level Control in Boiler.
 - (e) Chemical cleaning of water tube boiler.
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