Public Works (1898) Department.

G.O. No. 2702 W

LOCAL & MUNICIPAL SECRETARIAT

DATED 17th October 1898.

[Despatch Abstract.]

Madras Steam Boilers and Prime Movers Act 1893

Referring to the Locomotive Superintendent of the Madras Railway and General Superintendent P. W. workshops, for opinion, the rules submitted by the Sanitary Engineer to Govt for placing boilers under the charge of certificated men, and directing with remarks, that copies of the rules be circulated to the persons concerned.

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27. What is the difference between a "flash flue," a "split draft," and a "wheel draft"? What classes of boilers are each peculiar to?

28. What is a superheater? What is its construction? What valves are on it? There is sometimes a gauge glass on it; what is that for?

28. What is meant by a "fuel economiser"? What is its construction? What valves and cocks are on it? What is the pressure per square inch in it, in comparison with the pressure in the boilers to which it is joined?

29. What parts of a marine tubular boiler are first injured by shortness of water?

29. What parts of the "Loco. type" boilers are first injured by shortness of water?

30. Where are angle iron sometimes used in the construction of a boiler, and where are flanged plates used?

30. Where are angle irons used in the construction of a Cornish or Lancashire boiler? And where are flanged plates used?

31. Priming; to what causes is it attributed? What means are applied to prevent it? What evils may be produced by it?

32. Funnel draught; what makes it? What checks it?

32. What causes, and what checks furnace draft, with an ordinary factory boiler?

33. Flame is sometimes seen at the top of the funnel; what causes this appearance? Is it beneficial or is it detrimental? Why so?

33. Black smoke is sometimes seen at the top of a factory chimney; what is the cause of this? Is it beneficial or detrimental? Give reasons.

34. A blast pipe; what is its construction? Where is it placed? For what is it used?

34. A "blast pipe" is fitted to Loco. type boilers, what is its construction? Where is it placed? For what is it used?

35. How many bottom blow-off cocks are generally fitted to each boiler, and why are they so fitted?

36. Blow-off cocks are sometimes fitted with a spanner guard; for what purpose is this? Describe how the guard is formed.

37. Test cocks or water-gauge cocks; where are they placed? At what heights? Must the cocks themselves be at those heights? What provision is made for cleaning these cocks should they ever become choked? When there are no test cocks, how is the height of the water ascertained?

38. What is a dead-weight safety valve? Of what are the rubbing surfaces formed? How is a lock-up valve arranged to admit of lifting it or of turning it round, and to prevent adding to the weight?

39. About what area of safety valve is now required by the Board of Trade? What area was formerly required, and on what ground has that been altered? What is the effect of suddenly opening a safety valve when steam is up? To about what extent do safety valves rise when blowing off without being eased by hand?

40. Spring-loaded safety valves; what advantages have they that are not possessed by dead-weight valves? What are the disadvantages as compared with dead-weight valves?

41. Of what pieces does a glass water-gauge mounting consist? How does it act? Where is it placed? At what height? Is it liable to derangement? How is its working tested?

42. Glass water-gauges have sometimes pipe connections top and bottom; what is the object of this arrangement? Should there be cocks at the extremities of these pipes?

43. Describe a Bourdon steam-gauge. Some gauges have an inverted syphon pipe below them; what is its use?

44. Why is a small cock sometimes put on the pipe leading to a steam-gauge? Where should it be placed, and what error might be made by omitting to use it?

45. Do steam-gauges indicate the total pressure of the steam, or only a portion of that pressure? What is the pressure measured from?

46. What is meant by the salting of the boiler? How is this prevented? What is the density of ordinary sea water? How is the density ascertained? What is the difference between the formation of scale and the salting of the boiler?

47. Scum cocks and pipes; how are they arranged? Where are they placed? At what height in the boiler? When are they used? When must they be shut? Neglect of these cocks lead to what dangers?

48. Scale; of what does it consist? Where is it most objectionable? How is it removed? How is its formation prevented? What evil effects are produced by it?

49. What is a salinometer? Of what does it consist? How does it act? How is it graduated? Can it be used at any temperature indiscriminately?

50. What harm may be done through the check valve of one of a set of boilers being defective? How would you work to avoid this harm?

51. How is the leak from a split tube stopped in a boiler at sea? Describe the operation.

52. What is the use of dampers? Where are they fitted? When should they be used?

52. What is the use of dampers? Where are they fitted to Loco. type, Cornish, Lancashire, and Vertical boilers?

53. When there are no dampers fitted, what is used instead? What evil to the boiler is sometimes attributed to this? When the heating surfaces are clean, does this occur?

53. If no dampers were fitted to a Cornish boiler, how could the draft be regulated? What inconvenience would arise from the want of dampers?

54. Describe the piston of a steam cylinder, with its different rings and their uses.

55. Cylinder drain cocks; what is their use? There is sometimes a valve upon each cock; what purpose does it serve?

56. Cylinder escape valves; of what do they consist? How protected? How regulated? When are they most needed? To what danger do they expose the engineer? What precaution is sometimes used to obviate this danger?

57. What is a compound engine? What different kinds are there for screw steamers, in respect to the number and arrangement of their cranks and cylinders? What is a triple expansion engine?

57. What is a "compound engine"? What different kinds are there used in mills and factories, in respect to the number and arrangement of their cranks and cylinders? What is a triple expansion engine?

58. What is link motion? What are some of its advantages? In modern engines for the screw propeller, when there is no link motion, what takes its place?

58. What is "link motion"? What are some of its advantages? What motion is sometimes used in its stead?

59. What is a separate expansion valve? Why is it not fitted to all engines? What effect has an expansion valve upon the starting and upon the reversing of the engine?

60 What arrangement is applied to reduce the friction of a slide valve? To what is the friction due?

61. Describe a loose eccentric; how does it act? In what engines is the loose eccentric still employed?

61. Describe a "variable-eccentric"? How does it act? In what class of engine is it used?

62. What is the travel of the eccentric? How is it measured on the eccentric? What is the travel of the slide valve when the link motion is in mid gear, and the engine still moving?

63. What are "double beat valves"? Why are they not generally used for safety valves? Are they ever used instead of the slide valve? What objections are there to their use?

64. What is a circulating pump? Is it always worked by the main engine? Give an example from your last steamer of the three water temperatures generally noted by careful engineers.

64. What is a circulating pump? Is it always worked by the main engine? Give an example from the last factory you worked in, of the three water temperatures generally noted by careful engineers.

65. An air valve is sometimes fitted to a circulating reciprocating pump; what purpose does it serve?

66. What is the difference between a bucket air-pump, a piston air-pump and a plunger air-pump?

67. Whether are double-acting air-pumps, made with plungers, with pistons or with buckets?

68. What is an air-pump trunk? When is it necessary? How is it attached to the bucket?

69. Waht class of air-pump requires both foot and delivery valves, and in what other class can either of these valves be in some cases dispensed with?

70. When under way, when the air-pump bucket is at the top of its stroke, at what height is the water in the condenser?

70. When working at ordinary speed, when the air-pump bucket is at top of its stroke, at what height is the water in the condenser?

71. With a surface condenser and a single acting air-pump, what is the effect of a leaky foot valve, and what is the effect of a leaky bucket when there is also a foot valve?

72. Air-pump pet cock or valve; where is it placed? How does it act? What is its object? Does it in every case reduce the effective capacity of the pump? Is it equally applicable to double acting pump?

73. At what temperature is the hot well worked? What is the effect of higher temperatures? What is the effect of lower temperatures? What limits the lowness of temperature? Has a very low temperature any disadvantages?

74. Bilge injection with common condensers; what are the fittings required? When is it used? What precautions are necessary in using it?

74. Jet fittings to the surface condensers; what are required? When to be used? What precautions are necessary?

75. When surface condensers are used, what takes the place of the bilge injection? To what is the connexion made? How is its valve formed? Why is this necessary?

75. With surface condensers, what takes the place of the injection? To what is the connexion made? How is its valve formed? Why is this necessary?

76. What are the practical guides to the proper amount of opening of the inlet valve for the circulating pump?

77. Feed-pump pet cock or valve; where is it placed? What is its use? How does it act? Is it always a necessary fitting?

78. What are some of the ways of fastening the ends of surface condenser tubes? About what size and about what thickness are condenser tubes? What parts of a surface condenser are made of brass?

79. What is a blow-through valve or cock? To what is it attached? There is sometimes a valve that when opened admits steam from the slide valve casing to the exhaust port; what is its use? To which cylinder is it fitted?

80. What is a snifting valve? What is its use? Where is it placed? Can it be placed too high? Can it be placed too

low? At what height should it be placed? Was there one in your last steamer, if so, where was it? Why are snifting valves generally omitted now?

80. What is a "Hopkinson valve"? What is its use? Where is it fixed? How is it set? Can it be set too low or too high?

81. What connections are generally fitted to the donkey pump, and to what services can it be applied?

82. When the engines are stopped with steam up, what are to be shut and what are to be opened?

83. How is an engine heated up before starting? What precautionary examinations are made before starting?

84. What is an interceptor or catch-water? Where is it fixed, what is its construction, how does it act, and what attention does it require?

85. Describe an air-pump bucket, with its valve or valves and its packing. Of what are the valves generally made?

86. Of what materials are air pump rods made? Why so?

87. What is the racing of the engine? When does it occur? What danger attaches to it? What is done to prevent it?

87. What is meant by "unsteady driving"? Mention instances. What danger attaches to it? What is done to prevent it?

88. What are marine governors? What is their general construction? How do they act?

88. What are governors? What is their general construction? How do they act on "Corliss valves"?

89. What is meant by the "pitch" of a screw propeller? How is it measured?

89. What is meant by "spur driving," "rope driving" and "pelt driving?"

90. Explain the difference between a "right hand" and a "left hand" propeller, and state how each of them revolves.

90. Explain the difference between a right hand and a left hand engine?

91. What is the slip of a screw propeller? How is its amount expressed in figures?

92. Which of the valves about engines and boilers have to be worked by hand, which of them work self-actingly, and which are worked by the motion of the engine?

93. Why is soda sometimes put into a boiler, and how is it put in? What is the kind of soda used?

94. Tallow cups for cylinders were sometimes made with two small cocks, or with only one small cock, or with one large hollow plug cock, or with one small cock and a valve; which of these is suitable for a high-pressure cylinder, and which for the cylinder of a condensing engine? Describe how the cup with only one small cock is used? What is now generally used instead of these? How has this change come about?

95. Does a cylinder escape valve, self-acting, allow all the water to escape, if not, how much is left in the cylinder?

96. What is a "Steam Lubricator" (sometimes called an Impermeater)? Explain its action; to what part of the engine is it connected; whether will throwing cold water over it make it work faster or slower? Describe the one used in your last steamer.

97. A common paddle wheel; of what is the centre made? Of what are the arms formed? What is the form of the bolts which attach the floats to the arms? How are the arms attached to the centres?

98. Why have some paddle wheels one or more cast iron floats in each wheel? With what engines are these most required? At what part of the circumference are they placed?

99. Why are paddle-wheel floats sometimes made of different breadths in the same wheel? With what description of engine is this most needed? Where are the broad floats placed and where are the narrow floats placed in the circumference of the wheel?

100. What difference is there between a radial paddle wheel and one with feathering floats? What is the object of feathering floats? Are all the eccentric rods attached in the same way, and are they all of the same form?

101. Whereabout is the centre of the eccentric of a paddle wheel with feathering floats placed? In that case are the feathering levers on the striking face or on the back of the float? When the paddle shaft has an outer bearing, how is the eccentric made?

102. Of what materials are the working surfaces of a paddle wheel with feathering floats? Are they all lubricated? With what?

103. What is a "Disconnecting Paddle Engine"? At what place is the disconnecting effected? How is it accomplished? In which of the cranks of a disconnecting paddle engine are the crank pins fixed?

104. Whether is link motion valve gear or the loose eccentric generally used for disconnecting paddle engines? For what steamers are disconnecting paddle engines frequently employed?

105. What are expansion joints? Where are they necessary? What attention do they require? Of what should the working surfaces be made?

106. What omission in the construction of expansion joints may lead to a serious accident when steam is first applied? How is this prevented in the construction of a steam trunnion pipe for an oscillating engine?

107. Describe an oil cup with a syphon worsted. How is the worsted arranged? How is it cleaned? How far down the tubes does it extend?

108. Describe a thrust bearing; which of the surfaces wears? Why are there sometimes a number of the oil tubes for one thrust bearing?

109. What parts of a screw shaft are generally covered with brass? Why is this necesssary? About what thickness is the brass?

109. What is the usual speed of ropes, and what indicated H. P. does each rope usually drive, in ropes 5½ inches circumference driving spinning mills?

110. What is the stern tube or screw shaft pipe? Why is a pipe of such a length required? Of what is it made? How is it fixed at each end?

111. What is a lignum vitæ bearing? How is the wood fitted? Where is such a bearing generally used?

112. How is a screw propeller fixed on the shaft? What means are used to prevent its getting loose at sea?

113. Where are sluice valves placed? What large sluice valve is there in almost all screw steamers? From what position should this valve be worked? Why so? What attention should it receive?

114. With a condensing engine; what valves or cocks are on the skin of the ship in the engine room and in the stoke-hole?

115. What are the necessary fittings of a marine boiler?

116. With a surface condensing engine, what cocks or valves are opened some time before the engine is started so as to be ready for starting whenever the order is given?

117. What is a steamjacket? What cocks are on it? In what engines are jackets most generally used? Do they require to be felted?

118. What parts of an engine or its fittings should be felted or otherwise protected from radiation?

119. What are the small cylinders sometimes fitted on the slide valve casing over of vertical engines? Explain their action. To what are they connected by a pipe? Why so?

120. Name the principal pipes in connection with the engines and boilers of a steamer, and state to what the ends of these pipes are connected.

121. Through what cocks or valves, pipes and chambers does the water pass on its way from the sea inlet rose plate to the water space of the boiler, with a jet condenser?

122. Through what cocks or valves, pipes, and chambers does the circulating water of a surface condenser pass?

123. Through what cocks or valves, pipes and chambers does the steam pass from the boiler until it is in the form of water in the hot well?

124. Name the pieces of the engine through which the pressure of the steam is transmitted from the piston to the screw propeller. Name them in the order in which they act.

125. What is an air vessel? How does it act? At what parts of an engine or of its fittings are air vessels generally applied?

126. What is the construction of a mud-box? Where should mud-boxes be placed? Why are they necessary? How should the space be divided by the rose plate, and why?

127. What is a trunk engine? When used in a horizontal engine for a righthand screw propeller, at which side of the vessel should the cylinders be placed? Why so?

128. What is an oscillating engine? For what steamers are oscillating engines generally adopted? Why? How is the steam conveyed to and from the slide valve casing?

129. Of what parts does the valve motion gear of an oscillating engine consist?

130. For what have geared engines sometimes been used? Of what were the cogs of the large wheel made?

131. At what part of a screw steamer is the pressure that propels it applied to the hull?

132. At what part of a paddle steamer is the pressure that propels it applied to the hull?

132. Describe a "gusset stay," show how they are secured to both shell and end plate, state what you know for and against their use in Lancashire boilers.

133. About how much fuel per indicated horse power per hour is required by modern steam engines, common, compound, and triple expansion?

134. What is the explanation of the enconomy of the surface condenser?

135. What is the construction of a surface condenser? Of what are its tubes made? How are they fixed? How are they kept tight? What is done with a split tube?

136. Where do surface condensers foul? How are they cleaned?

137. What non-conducting substances are employed to prevent radiation, and how are they applied?

138. In the construction of smoke-box doors and of dry uptakes, what provision is made to lessen the amount of radiation?

138. With "portable engines," what provision is made to prevent ashes and sparks injuring adjacent property?

139. How can the formation of black smoke be prevented? Describe smoke preventing apparatus.

140. What is meant by "circulation" in a boiler, and what are the results of defective circulation?

141. What means are sometimes adopted to improve the circulation in a boiler?

142. By what arrangement is the circulation promoted in a "haystack" boiler?

142. How can extra heating surface be gained in Lancashire and Cornish boilers? Is it on the whole advantageous?

143. Describe a ship's side air pump discharge valve, in what respects does it sometimes differ from a common stop valve, and what attention does it require?

143. What "fittings" are usually on a steam receiver between a high pressure and low pressure cylinder?

144. What is the construction of a feed escape valve, to what is its discharge connected, and how is its loading regulated?

145. When there is no feed escape valve, what is the arrangement of the feed valves or cocks?

146. When is the measure of a horse power? How is indicated horse power ascertained?

147. Has "nominal horse power" a fixed meaning? What is the use of this expression? What is generally taken as the measure of one-horse power nominal?

148. What is "back pressure" in a cylinder? About how much is it in each of the cylinders in your last steamer? Is excessive cushioning ever a trouble under certain conditions in modern engines? Say when and why and in which cylinder this occurs.

148. What is meant by "back-pressure" in a cylinder? About how much was it the last engine you were with? Is excessive cushioning ever a trouble under certain conditions in modern engines? Say when and why, and in which cylinder this occurs.

149. What is meant by "speed of piston"? About how much is the speed of piston in modern marine engines?

149. What is meant by "piston-speed," and about how much is it in mill engines, and how much in non-condensing factory engines?

150. What is "atmospheric pressure"? What is its average amount? What instrument tells this amount?

151. What is "gross pressure" or "absolute pressure"? What pressure is it that is shown by the steam gauge?

152. What is meant by "cutting off" steam? How is it done? What part of the valve regulates the cut off?

153. What is a piston slide valve? Describe its construction. Why are such frequently employed in place of the common slide valve? What is a great drawback to the use of these valves?

176 and 177. What parts of a marine engine are exposed to danger when the temperature is below freezing point? What precautions are necessary in cold climates when the temperature is below freezing?

176. What is the average difference between the temperature of the feed water on entering and leaving an ordinary mill fuel economiser?

177. What is the general temperature of the gases at the base of the chimney attached to a range of boilers in a cotton mill?

178. State as many ways as you can by which a boiler might not get its full speed; that is, a boiler, or one of a set of boilers, gets short of water although the feed valve is open its proper amount; to what causes might this be due?

179. Of what are furnace bars generally made? About what thickness are they at top? About what space is between them? Whether are the bars put further apart for Newcastle coal or for Welsh coal?

180. Which burns faster, Newcastle coal or Welsh coal? Which is the flaming coal? Which makes most smoke?

181. About how many tons of steam coal will be burnt per day in four furnaces, each 3′ 0″ wide, and of about the usual length? On what grounds do you say so?

182. About how many tons of steam coal will be burnt per day with good compound engines to drive an ordinary steamer of 40 feet beam 10 knots an hour by steam alone? On what grounds do you say so? What percentage more coal would be required to propel the same steamer one knot faster?

183. About how many tons of steam coal will be burnt per day with a good compound engine, surface condensers, the low pressure cylinder 70 inches diameter doing average work? On what grounds do you say so?

184. A pair of inverted cylinder direct acting engines, there is a liner half an inch thick between the head eccentric rod and the eccentric strap, in overhauling the engine this piece is lost and forgotten; what difference will its omission make in the working of the engine, on the admission, on the cut-off, and on the exhaust of the steam? Which will take place earlier and which later, distinguishing between the up stroke and down stroke?

185. A pair of inverted cylinder direct acting engines driving a right-hand screw; on which of the crosshead guide bars is the pressure greatest in the up stroke, and on which in the down stroke?

185. With a horizontal engine with the fly wheel running in the usual direction; which crosshead guide gets the most strain? And on which stroke is the strain greatest? Sketch your meaning.

186. A screw propeller is getting loose, it has a little play on this show in the shaft, sideways on the key or feather; how will this show in the engine room?

186. The "toothed segments" in a spur driving wheel are getting loose; how will this show in the engine room?

187. How would you prove whether the centre line of the trunnions of an oscillating cylinder be fair with the centre line of the main shaft?

187. How can you prove whether the main shaft is true with a line through the cylinder?

188. How can the fairness of a line of screw shafting be tested without lifting the shafts?

188. How can the fairness of a pair of bevil wheels be tested? Explain how they are adjusted.

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Elementary Questions

1. What parts of an engine are generally made of wrought iron?

2. What parts of an engine are generally made of cast iron?

3. For what part of an engine is steel sometimes used?

4. What parts of an engine are generally made of brass or gun metal?

5. Where is "white metal" sometimes used? On account of what property possessed by it is it adopted? What objection is there to its more general use?

6. For what parts is Muntz Metal sometimes used? Is it malleable? For what properties is it valued?

7. What difference is there in the composition of cast iron, of wrought iron, and of steel?

8. How can cast iron, wrought iron, and steel be distinguished from each other?

9. What are the different properties of cast iron, of wrought iron, and of steel?

10. What is meant by the terms, "breaking stress," "proof stress," "safe working stress"?

11. What is the cohesive strength, or breaking stress, of good ordinary wrought iron?

12. Tempering steel; how is it done, and in what order do the colours come?

13. What is case-hardening?

14. Which of the common metals or alloys can be forged, and which of them are brittle or "short"?

15. What is meant by "welding"? Which of the common metals can be welded?

16. The expansion of metals by heat: give examples of this in the engine and in the boiler.

17. In the construction of cylindrical marine boilers, for what parts have the plates to be worked hot? When the material is steel, what precautionary treatment of these plates is afterwards necessary?

18. What is double rivetting? In what parts of cylindrical marine boilers is double rivetting employed? In which of the shell seams is it most necessary?

19. What is "caulking," and how are seams prepared for caulking?

20. Describe the different ways of fastening the ends of the main stays of a boiler. What are the merits of, or objections to, the different plans?

21. What strain per square inch is allowed on boiler stays?

22. Describe a rivetted stay, and state where such stays are commonly used?

23. Where are thin plates to be looked for in a boiler as it wears, and how is the thinness to be detected?

24. How are boiler tubes fixed? What are "stay tubes," and how are they secured?

25. Where is it generally that boiler tubes leak? How is this defect repaired? What are the causes of this leaking?

26. What are the causes of cracked tube-plates? Where are the cracks situated? How are they repaired?

27. What is the difference between a "dry uptake" and a "wet uptake"? Which requires most repair? Why? Where have you seen a wet uptake?

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

GENERAL.
ESTABLISHMENT.

Government {1898} of Madras.

PUBLIC WORKS.

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G.O., No. 2702 W., 17th October 1898.

OCTOBER.

Madras Steam Boilers and Prime Movers Act, 1893

Referring to the Locomotive Superintendent of the Madras Railway and the General Superintendent, Public Works Workshops, for opinion, the rules submitted by the Sanitary Engineer to Government for placing boilers under the charge of certificated men, and directing, with remarks, that copies of the rules be circulated to the persons concerned.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Establishment.

READ—the following papers:—

From J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government, to the Secretary to Government, Public Works Department, dated Fort St. George, 19th August 1898, No. 1277

In reply to your memorandum No. 594 D. of 6th July 1898, I have the honour to inform you that I have drawn up in communication with the Boiler Inspector a set of rules which are, I think, a complete reply to your queries Nos. 1—3 and 4 and with reference to these rules forwarded herewith I proffer the following remarks.

2. The rules are based on the Bombay rules but in some few particulars are less stringent. A copy of the Bombay rules is sent for comparison. The rules in many respects have had to be re-drafted owing to officers, different from those in Bombay, administering the Act here, and the rules put forward in this respect are such as seem suitable to the circumstances of Madras Administration; such rules do not, of course, affect the stringency or otherwise of the examinations.

3. The other main points in which the rules differ are (1) in regard to fees, a second chance being given for the same fee to a failed candidate—*vide* rule 11, Madras and 11, Bombay. I think this is desirable looking to the class of men in Madras who are drivers and who are not as a rule too highly paid; (2) in regard to the examination for second-class certificates of competency where conditions (*g*) and (*h*) of rule 28 (Bombay) are transferred to the 1st class (proposed Madras rules), the Boiler Inspector agrees with me in thinking that the amended rules for persons desiring to obtain second-class certificates are stringent enough as we have not here the very large number of well qualified men to be found in Bombay and the Bombay rules apparently refer to sea-going Engineers as well as to Engineers of land engines; (3) in regard to certificate of service [proposed rule No. 44 (*a*)] this has been amended to ensure that a person once having obtained a certificate of service cannot obtain a further one of higher grade but can reach the higher grade by obtaining a certificate of competency on passing the appropriate examination.

4. In other respects the rules are practically those of Bombay and seem suitable to Madras as amended.

5. Referring more particularly to your queries Nos. 1 to 4—

(1) The rules show how the examination will be instituted. I considered whether the examination might not fall into line with the technical examinations of Government, but it appeared to me for many reasons but especially because the rules are framed with reference to an Act administered by this department and observing, moreover, that the licenses must be registered here, that it is advisable to have the examination quite separate.

(2) Provision for the appointment of examiners will be found in rule 1. It will be observed that the Act prohibits the appointment of a Boiler Inspector as examiner and I presume this debars me as Ex-officio Inspector. The persons who would be most suitable for examiners would be Mechanical Engineers, such as—

(*a*) The Locomotive Superintendent, Madras Railway.
(*b*) The Deputy Locomotive Superintendent, Madras Railway.

(*c*) The partners of Messrs. Massey & Co.
(*d*) The Chief Engineers of the Carnatic, Buckingham, Choolay Mills, &c.
(*e*) The Engineer of MESSRS. Oakes & Co. The Engineer of Messrs. Borham & Co.
(*f*) The Mechanical Engineer of the Madras Municipality.
(*g*) The Locomotive Foremen, Madras and South Indian Railways.
(*h*) The Mechanical Engineer of the Gun Carriage Factory.
(*i*) The Mechanical Engineer of the Arsenal.

The rules provide for two of the examiners being Mechanical Engineers while the third might be a Public Works or other officer of Government. As however it is proposed that the examiners be appointed annually, names could be submitted from time to time.

(3) The proficiency required for each class is regulated by the proposed rules.

(4) The examination should be made compulsory 18 months after date of issue of rules. This will be no hardship because under rules 23 to 26 certificates of service can be obtained by all those persons who shall have been for three years in charge of engines when these rules began to operate, that is, they must have 18 months' service before the publication of the rules. The former period is much longer than was given in Bombay, the notification appearing in November 1874, and the 1st October 1875 being named as the date after which no person not qualified under the rules should be in charge of a boiler. It is true that such persons have to satisfy the examiners of their capability (*vide* rule 43), but it is evident that this rule must be worked with discretion and leniency because men might otherwise be deprived of making a living by the profession they had adopted and which, previous to the issue of the rules, no person could prevent them from following; practically every one who had been in charge of boiler and engine for the period stated would be granted a certificate unless he showed the most gross ignorance and that his continued employment had been due to good luck and not good guidance.

6. I do not think that I need to further remark in regard to the rules as proposed, but I would add that I deem it a matter to be considered whether the rules should not be extended to the whole Presidency; that portion of the Act relating to the examination of boilers is in force only in the city of Madras and that portion I do not propose should be extended meantime, but it would add immensely to the security of person and property if all persons in charge of boilers within the Presidency were certificated. This is a point for consideration by Government.

7. Meantime, orders for the issue of the notification regarding rules proposed might be obtained, as Government would then be able to observe how the proposed regulations were received in Madras itself; the rules would require slight modification if extended to the mofussil.

ENCLOSURES.

NOTIFICATION.

In exercise of the powers conferred by section 14 of the Madras Steam-boilers and Prime-movers Act III of 1893, His Excellency the Governor in Council proposes to notify that, after a date to be hereafter fixed which will not be less than 18 months from the date of intimation, no boiler shall be used within the city of Madras unless it is in the direct and immediate management and charge of a person certified under the above Act to be competent for the charge thereof, and under section 23, clauses (*c*), (*d*) and (*e*) of the same Act proposes to issue the following rules:—

(1) for regulating under clause (*c*) the grant and record of certificates of competency and of service;

(2) for the conduct under clause (*d*) of examinations for such certificates and for regulating the fees to be charged for admission to the same;

(3) for providing under clause (*e*) for enquiry into an allegation of drunkenness, misconduct or negligence on the part of the holder of a certificate of competency or service.

2. The Government will consider any suggestions made in respect of these rules which may be received on or after the first day of January 1898.

I.—Board of Examiners.

3. The Board of Examiners shall be nominated annually by Government. The examination shall be held at such places as may be notified by Government. Government will nominate not less than three persons to be examiners and shall nominate one of such persons as President of the Board of Examiners; at least two of such examiners shall be Mechanical Engineers in actual practice in the Presidency of Madras.

4. The examiners from time to time nominated above shall receive a fee of Rs. 25 per diem for each examination, but not less than Rs. 50 for each half-yearly examination which he attends from beginning to end.

5. The examiners shall endorse on the printed application of each candidate the result of his examination for a certificate of competency, and shall send to the Sanitary Engineer the application so endorsed.

II.—Examinations.

6. Examinations shall ordinarily be held in the city of Madras twice a year and at intervals of not more than six months. The first examination shall be held six months after the date of the publication of these rules.

7. Every examination shall be attended by one or more clerks from the office of the Sanitary Engineer to Government or the Inspector of Steam-boilers and Prime-movers, who shall do such clerical work as may be necessary and shall act as interpreter when required to do so by the Board of Examiners.

8. The examinations shall be of three kinds, one for each of the three classes of certificates of competency which the examiners are hereinafter empowered to grant.

III.—Admission of Candidates to the Examinations for Certificates of Competency.

A.—General.

9. Candidates at examinations for certificates of competency shall pay fees at the following rates:—

	Rs.
For a 1st-class certificate	20
„ 2nd „ „	10
„ 3rd „ „	5

10. Unsuccessful candidates will not be entitled to a return of any portion of the fees paid by them; but, if applied for, the fee paid by an applicant, who is not admitted to examination, will be returned to him in full, provided that, in the event of a candidate being unavoidably absent from any examination for which he has paid a fee, it shall be in the discretion of the President of the Board of Examiners to allow him to appear at any examination held within one year of the first examination without a second payment of fee.

11. Any candidate after failure may appear at a succeeding examination for the same class of certificate without payment of a further fee on such date as the Board of Examiners shall determine under rule 10.

12. Every applicant for examination must make an application in the form of appendix A. He shall duly fill in all the parts of the said form which are to be filled in by a candidate, and sign the same in the presence of his employer or a municipal tax-payer of not less than Rs. 50 per annum who shall append his signature in token of attestation. The applicant shall then lodge his application at the office of the Sanitary Engineer (Ex-officio Inspector of Steam-boilers and Prime-movers) not later than twenty-one days before the date fixed for the examination, together with—

(*a*) all testimonials of good character, sobriety, experience and ability, together with copies of the same;
(*b*) any other papers required by these rules or the printed form of application;
(*c*) a receipt from a Government treasury for the amount of the fee prescribed in rule 9 for the examination at which he wishes to appear;
(*d*) a letter declaring in what language he desires to be examined; and
(*e*) all previous certificates, if any, issued to the applicant under the Act.

13. Candidates for certificates of competency who are natives of India must prove to the satisfaction of the examiners that they can read their vernacular sufficiently well to perform the duties required of them.

B.—Testimonials.

14. No applicant will be admitted to examination whose testimonials as to sobriety experience and ability do not relate to a period of at least twelve months immediately preceding the date of application to be examined, and are not, in the opinion of the Sanitary Engineer trustworthy and satisfactory.

15. The testimonial for any period during which the candidate acted as a Chief Engineer must be signed by the manager, owner or secretary by or under whom the candidate was employed and for such period as he acted as a second or lower grade Engineer must be signed by the Chief Engineer, to whom the candidate was subordinate; but if, for any sufficient reason, the Chief Engineer's signature is not obtainable, it may be signed by the manager, owner or secretary, but the testimonial must declare that the facts stated therein are either in accordance with the reports of the Chief Engineer, or, if no such reports are available, are within the personal knowledge of the person signing the same.

16. Testimonials relating to service beyond the limits of British India must be countersigned either by the consul, or by some other recognised official authority of the country in which the service was performed or, in the case of the Native State, by the Political Agent: or must be authenticated by the testimony of some credible person on the spot having personal knowledge of the facts required to be established.

17. If the Sanitary Engineer has reason to doubt the truth of any fact stated in any application or testimonial he may make such enquiries as he shall think fit.

18. The applications and copies of the testimonials referred to in rule 10 shall, before the date of the examination, be forwarded by the Sanitary Engineer to the President of the Board of Examiners with a certificate to the effect that the candidate is eligible for examination under the rules. The original testimonials shall be filed in the office of the Sanitary Engineer and shall, at the close of each examination, be returned to the candidates who presented them if they apply for the same.

C.—Age and Training of Candidates.

Training of candidates for third-class certificates.

19. A candidate for a third-class certificate of competency will not be admitted to examination, unless he (*a*) is qualified within the meaning of the rules next following as a candidate for a second-class Engineer's certificate of competency, or unless he (*b*) proves, to the satisfaction of the Sanitary Engineer, that, previous to his application, he has been three years employed as a fireman on engines and boilers, or (*c*) produces satisfactory certificates stating that he has completed a three years' course in the workshops of a recognised college or institute and during that period has been constantly instructed in the management of engines and boilers.

Age and training of candidates for second-class certificates.

20. A candidate for a second-class Engineer's certificate of competency must be not less than twenty-one years of age. No candidate for a certificate of this class will be admitted to the examination, unless he proves to the satisfaction of the Sanitary Engineer that previous to his application—

(*a*) he has served an apprenticeship for not less than three years to an Engineer, and that, during that time, he has been employed on the making or repairing of engines; or
(*b*) he has been employed for not less than three years as a journey-man mechanic in some factory or workshop on the making or repairing of engines; or
(*c*) he has, for not less than two years, fulfilled the requirements either of clause (*a*) or of clause (*b*) as to service or employment, and has, for not less than one year in addition thereto, served as Engineer in charge or Assistant Engineer in some mill or factory with boilers under steam; or
(*d*) having obtained a third-class certificate has since been in independent charge of engines and boilers for a period amounting to at least two years; or
(*e*) unless he produces a satisfactory certificate stating that he has completed in the workshops of a recognised college or institute a three years' course and during that period has been constantly instructed in the management of boilers and engines.

Age and training of candidates for first-class certificates.

21. A candidate for a first-class Engineer's certificate of competency must be not less than twenty-two years of age. No candidate for a certificate of this class will be admitted to the examination unless he proves, to the satisfaction of the Sanitary Engineer, that previous to his application—

(1) he is qualified as is required by rule 20 in the case of a candidate for a second-class Engineer's certificate of competency; and also proves that—

(2) either—

(*a*) he possesses or is entitled to a first-class Engineer's certificate of service; or, if he neither possesses nor is entitled to a first-class certificate of service,

(*b*) that he has served—

(i) for at least one year with boilers under steam as Engineer with a second-class Engineer's certificate of competency, or

(ii) for at least two years with boilers under steam as Engineer with a second-class Engineer's certificate of service, or

(iii) for at least one year with boilers under steam as second Engineer with a second-class Engineer's certificate of service and in addition for at least six months as Chief Engineer with boilers under steam which are by law required to be in the charge of an Engineer holding a certificate:

provided that if an applicant, who is able to satisfy the Sanitary Engineer as to the character of his services, has, in consequence of service abroad, been unable to obtain a second-class certificate of competency or of service, he may be allowed, if the Sanitary Engineer see fit, to be examined for a first-class certificate of competency or of service although he has not obtained a certificate of the lower grade.

22. Any person qualified under the rules hereinbefore contained to appear for examination as a candidate for a certificate of any class other than the third-class may be permitted to appear for examination as a candidate for a certificate of any class inferior to that for which he is so qualified to appear as a candidate.

D.—General Rules regarding service.

23. Every candidate, who applies for a certificate of service (section 18 of the Act), must show by his testimonials that he has been regularly employed in the engine-room as an Engineer of a certain grade.

24. Service with boilers not continuously under steam shall count as service of half the same length with boilers continuously under steam unless the candidate proves that more than half of such service was actually under steam; and the candidate must show by his testimonials whether the boilers with which he has worked were or were not continuously under steam.

25. Service as an Engineer means service in those capacities only which afford opportunities of obtaining practical experience as an Engineer on engines, boilers and their appurtenances; it does not include service as a fire-man, stoker, donkey-man, greaser, winch-man, labourer or Engineer's steward.

26. Service performed in places where the Act is not in force may be accepted as qualifying service subject to the same rules as those which apply to service performed in places where the Act is in force.

IV.—Subjects of Examination for Certificates of Competency.

Third-class.

27. To be entitled to a third-class certificate of competency a candidate must satisfy the examiners that—

(*a*) he fully understands the working and management of boilers, the use of the best means of firing for the prevention of smoke, and the separate use of gauge glass-cocks, blow-off cocks, scum-cocks and other appliances;

(*b*) he is able to some extent to explain the actual working of engines and the separate uses of feed-pumps, slide-valves, pistons and other appliances;

(*c*) he is able to show what ought to be done in case of the break-down of any portion of the machinery, &c.

28. To be entitled to a second-class certificate of competency a candidate—

(*a*) must give a description of boilers and the methods of staying them together with the use and management of different valves, cocks, pipes and connections;

(*b*) must understand how to correct defects from accident, decay and other causes, and know the means of repairing such defects;

(*c*) must understand the use of the barometer, thermometer, salinometer and the principles on which they are constructed;

(*d*) must know the causes, effects and usual remedies for incrustation and corrosion;

(*e*) must state how a temporary or permanent repair could be effected in case of a derangement of a part of the machinery, or of total break-down;

(*f*) must write a legible hand and understand the first four rules of arithmetic and their application to questions about consumption of stores and capacities of tanks;

29. To be entitled to a first-class certificate of competency, a candidate must be able to—

(*a*) make an intelligible hand sketch or a working drawing of some one or more of the principal parts of a steam engine; and to mark in, without a copy, all the necessary dimensions in figures, so that the sketch or drawing could be worked from;*

(*b*) take off and calculate indicator diagrams;

(*c*) calculate safety-valve pressure and the strength of the boiler shell, stays and revetting;

(*d*) pass a creditable examination as to the various constructions of engines in general use and as to the details of different working parts, external and internal, and the use of each part;

(*e*) state the general proportions borne by the principal parts of the machinery to each other, and calculate the direct stress, tortional stress and the bending stress, in round bars, and the direct stress and the bending stress in rectangular bars with given loads;

(*f*) explain the method of testing and altering the setting of the slide-valves, and sketch approximately what difference any alteration in the slide-valve will make in the indicator diagram, and also explain the method of testing the fairness of shafts, and of adjusting them;

(*g*) possess a knowledge of the prominent facts relating to combustion, heat and steam;

(*h*) explain surface condensation, super-heating and the working of steam expansively, the duty of pumps and the direct strains in engines and boilers;

(*i*) work calculations including the mensuration of superficies and solids and the extraction of the square root, and the application of these rules to questions relating to the power, duty and economy of engines and boilers and to the stresses in rods, shafts and levers of the engine.

V.—Mode of Examination.

Examination to be practical.

30. Every examination shall be of such a nature as to test the practical knowledge of the candidates and to ascertain their competency to manage boilers and prime-movers.

31. The examination for third-class certificate will be conducted *viva voce* in the city of Madras and will be held, if possible, in a workshop, mill or foundry where the candidate's knowledge can be practically tested in the use of the steam, vacuum and water gauges.

First and second class.

32. (1) Each candidate for first and second class certificates will in the first place be called upon to give written answers within a prescribed time to ten of the "elementary questions" appended to these rules. If the candidate's answers are not satisfactory, his examination will cease, and he shall be declared to have failed.

(2) If his answers to the ten questions are satisfactory, the candidate will be called upon—

(*a*) If a candidate for first-class certificate—

(1) to answer within a fixed time, a paper of ten questions in arithmetic as specified in clause (i) of rule 29;

(2) to make within a prescribed time a rough drawing of some part of a boiler or engine;

(3) to answer *viva voce* questions on the subjects specified in clauses (*b*) to (*h*) both inclusive, of rule 29, and on the papers which may have been set to him.

(*b*) If a candidate for second-class certificate—

(1) to answer within a prescribed time a paper of ten questions in arithmetic as specified in clause (*f*) of rule 28;

(2) to answer *viva voce* questions on the subject specified in clauses (*a*) to (*e*), both inclusive, of rule 28 and on the papers which may have been set to him.

(3) Answers to written questions must be worked out in the presence of at least one of the examiners.

(4) Each candidate's answers to written questions must be given up on the expiry of the time prescribed whether his answers are then complete or not.

(5) If, at the expiry of the time prescribed, the candidate has failed to work out the whole of the questions set to him, but the result of the *viva voce* examination, taken in connection with the answers to such of the questions as he has worked out, satisfies the examiners that the candidate is competent to take charge in the case of—

(i) a candidate for first-class certificate of boilers, whatever their nominal horse-power, and in case of

(ii) a candidate for second-class certificate, of boilers not exceeding sixty nominal horse-power

he shall be declared to have passed, otherwise the candidate shall be declared to have failed.

* See Appendix Q.

33. When a candidate for a certificate fails to satisfy the Board of Examiners as required by these rules, the Board shall fix a period, after the expiry of which he may again appear for examination and shall inform him thereof; and the candidate shall not be at liberty to appear again for the examination at any place at which an examination is held under the Act until after the expiry of the period so fixed.

VI.—Rules for the Examination Room.

34. The examination in rough working drawing which candidates for first-class certificates have to pass under rule 29 (a) may, at the candidate's option, be applied either to hand sketches clearly dimensioned and complete in the necessary *views* and *sections* or to drawings to a scale. Candidates will have to bring with them any drawing instruments they may require.

35. A candidate discovered (*a*) to have taken into the examination room any book, paper, document or memoranda of any description, or (b) copying from or affording, giving or receiving any assistance or any information to and from, or communicating in any way with another candidate during the time of examination, shall be regarded as having failed in his examination, and will be turned back for six months, in the same manner as if he had failed in the practical part of the examination; but in such case no part of the fees he may have paid for examination will be returned to him.

36. If a candidate leaves the room before answering any question which has been given to him, he cannot afterwards be permitted to answer it, but the examiner may substitute other data, or another question.

VII.—Grant of lower-grade certificates in certain cases.

37. If a candidate allowed under the proviso to rule 21 to be examined for a first-class certificate though he has not obtained a certificate for a lower grade, or if a candidate already in possession of a certificate of service fail to pass the examination for the higher grade but pass the examination for the lower grade, he may receive a certificate for the grade passed, but no part of the fee paid by him will be returned.

38. A candidate who has been permitted to be examined for a first-class certificate of competency under the proviso of rule 21 without first obtaining a second-class certificate of competency or a first-class certificate of service, and who fails in his examination in practical knowledge, shall not be re-examined for a certificate of that grade until he has served 12 months as second Engineer with a second-class Engineer's certificate of competency as required by the rules.

39. If the candidate fails in the examination for the lower as well as for the higher grade of certificate, he may be re-examined for a second-class certificate only subject to the provisions of rule 33.

VIII.—Postponement of grant of certificates in certain cases.

40. (1) If, after a candidate has passed his examination, it is discovered that his services are insufficient to entitle him to a certificate of the grade for which he has passed, such certificate will not be granted to him; but if the Sanitary Engineer is satisfied that the error in the calculation of his services did not occur through any fault or wilful misrepresentation on the candidate's part, the Sanitary Engineer shall report the facts to the President of the Board of Examiners who may direct the certificate to be issued, or may allow the candidate to appear for re-examination without payment of further fee, when he has performed the deficient service.

Short service.

(2) If, in such a case, the applicant's services are sufficient to entitle him to receive a certificate of a lower grade provided as aforesaid he has not wilfully misrepresented the amount of his services, a certificate of such lower grade may be granted to him, but the difference between the fee paid by him for the superior certificate and the fee payable for the inferior certificate shall not be refunded.

(3) In such a case, when the applicant has by further service made up the time in which he was found to be deficient, he may be required,

28. To be entitled to a second-class certificate of competency a candidate must receive the higher certificate, to

(*a*) [illegible] re-examination. before he can be examined in all the subjects.

be re-examined in [illegible] *cates.*

IX.—Surrender of lower-grade certificates on accident, decease [illegible]

41. No certificate of the first or second class shall be granted to the holder of the certificate of a lower grade unless and until the holder has surrendered to the Sanitary Engineer the certificate of the lower grade.

Holder of lower-grade certificate to surrender it before grant of first or second grade certificate.

42. Every certificate of competency granted under section 15 of Act III of 1893 to a person in possession of a certificate entitling him thereto under the said section shall be in the form in this behalf provided in Appendix B, and shall be endorsed on the certificate of competency by virtue of which such person is so entitled as aforesaid.

X.—Certificates of Service.

43. In order (1) to ascertain that a candidate for a certificate under section 18 of the Act is possessed of competent skill for the charge and management of a boiler, and (2) to determine what class of certificate he is qualified to hold, the Board of Examiners shall subject him to such practical examination as they in each case think fit.

Examination to be practical.

44. Applicants for certificates of service will be charged fees at the following rates:—

	RS.
First class	10
Second class	5
Third class	3

44-A. A person having once received a certificate of service shall not be granted a further certificate of service of higher grade, but may obtain a certificate of competency of higher grade under rules 28 to 33.

XI.—Form of Certificates.

45. Certificates of competency and of service shall be in the forms given in Appendix B, respectively, or to the like effect.

46. Applications under section 17 of the Act for certificates of competency corresponding to foreign certificates in the possession of the applicants, shall be in the form of Appendix A. Each applicant shall duly fill in the form, and together with copies of the original foreign certificates in his possession, shall lodge the form with the Sanitary Engineer at least 10 days before a half-yearly examination.

Certificates under section 17.

47. Holders of certificates of the first class shall be deemed capable, as first-class Engineers, to have charge of boilers attached to prime-movers of any horse-power.

Capabilities of holders of certificates.

48.* Holders of certificates of the second class shall be deemed capable, as second-class Engineers, to have charge of boilers attached to prime-movers not exceeding 60 horse-power nominal.

49.* Holders of certificates of the third class shall be deemed capable as third-class Engineers to have charge of boilers attached to prime-movers not exceeding 20 horse-power nominal.

50. Written applications for duplicates under section 20 of the Act shall be lodged with the Sanitary Engineer together with a declaration of the loss of the certificate and other documents relied upon by the applicant.

Duplicate certificates how to be obtained.

51. Duplicates of all certificates granted under the Act shall be recorded in the Boiler Inspector's office, Madras.

Record of duplicates.

XII.—Misconduct of Holders of Certificates.

52. Should it come to, or be brought to, the notice of the Sanitary Engineer, that any person holding any certificate under Act III of 1893, has, when on duty, been drunk, or has misconducted himself, or been negligent in respect to his duties, the Superintending Engineer shall, if he deems it necessary, report the facts to Government in order that the matter may be dealt with under section 19 of Act III of 1893. On any such enquiry having been ordered by Government the holder of the certificate about whose conduct the enquiry is instituted shall be called on to surrender his certificate to the Sanitary Engineer to be retained by him until Government pass orders on the result of such enquiry and should such certificate not be surrendered within three days from date of receipt of such call, the provisions of clause 2 of section 19 of the Act will be enforced.

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* NOTE.—For the purpose of the above rules the following formulæ shall be used to determine the nominal H.P.—

For single cylinder engines condensing or non-condensing, $\frac{S}{10}$.

Where S = the square of the diameter in inches of the cylinder.

For compound engines, $\frac{S}{32}$.

For triple expansion engines, $\frac{S}{22}$.

Where S = Sum of the squares of the diameters in inches of all the cylinders of an engine.

APPENDIX A.

MADRAS ACT III OF 1893.

Rotation No.

APPLICATION for an Engineer's certificate of competency under section ______

(a) Name, &c., of Applicant.

Names at full length.	Surname.	Permanent address, stating town, street, and number of house and name of person (if any), with whom residing.
1	2	3

Date of birth.			Where born.	
Day.	Month.	Year.	Town.	Country.
4	5	6	7	8

(b) Particulars of all previous Certificates (if any) whether issued in British possessions or elsewhere.

Number.	Competency or service.	Grade.	Where issued.	Date of issue.	If at any time suspended or cancelled, state by what court or authority.	Date.	Cause.
9	10	11	12	13	14	15	16

(c) Certificate now required.

Grade.	Competency or service.	Address to which it is to be sent.
17	18	19

Certified that the applicant is eligible under the rules for examination.

To
The President, Board of Examiners.

Sanitary Engineer to Government.

(d) If applicant has failed in a previous examination for the certificate now required, he must here state when and where. If he has not failed, he must state so in writing across this division.

Day.	Month.	Year.	Town.	Subjects in which he failed.
20	21	22	23	24

(e) Declaration to be made by Applicant.

(Take notice).—Any person who makes, procures to be made, or assists in making, any false representation for the purpose of obtaining for himself or any other person, a certificate either of competency or service *will be criminally* prosecuted.

I do hereby declare that the particulars contained in divisions (*a*), (*b*), (*c*), (*d*) and (*f*) of this Form are correct and true to the best of my knowledge and belief; and that the papers enumerated in division (*f*) and sent with this Form are true and genuine documents, given and signed by the persons whose names appear on them. I further declare that the statement (*f*) contains a true and correct account of the whole of my services without exception.

And I make this declaration conscientiously believing the same to be true.

Dated at this day of 189 .

Signed in the presence of

Signature of applicant.

Present address.

(f) List of Testimonials and Statement of Service.

(The testimonials to be numbered consecutively according to the number given in column 25 below) :—

Number of testimonials (if any).	Where employed.	Horse-power of engines.	Style of Factory.	Service of applicant.						Remarks.	Initials of verifier.
				Capacity.	Date of commencement.	Date of termination.	Time employed in this service. Years.	Months.	Days.		
25	26	27	28	29	30	31	32	33	34	35	36
Total Service ..											
Time served for which certificates are now produced ..											
Time served for which no certificates are produced ..											

(g) Certificate of Examiner.

NOTE.—The Examiner should fill up divisions (*g*) and (*h*) and in all cases, as soon as possible, forward this paper to the Sanitary Engineer. If the applicant passes, his testimonials and previous certificates, if any, must be sent with this paper. The certificate and the testimonials will be delivered to the applicant at the office of the Sanitary Engineer.

Date and place of Examination.		Insert passed or failed in each column.		Rank for which passed.
Date.	Place.	In working out the questions.	In the *vivâ-voce* examination.	
37	38	39	40	41

(h) Personal Description of Applicant.

Height.		Complexion.	Finger marks, personal marks and peculiarities.	Colour of	
Feet.	Inches.			Hair.	Eyes.
42	43	44	45	46	47

I hereby certify that the particulars contained in divisions (*g*) and (*h*) are correct.

This form and the testimonials are returned to the Sanitary Engineer.

This day of 189 .

Signature of Examiner.

To

The Sanitary Engineer and

(Ex-officio) Inspector of Steam-boilers and Prime-movers, Madras.

APPENDIX B.

(SEE RULES 42 AND 45.)

Form of Certificate of Competency.

CERTIFICATE of Competency of the class granted under the Madras Act III of 1893.
No. of 189 .

A.B., aged about , at present residing at , having satisfied the Board of Examiners appointed under the above Act, of his competency to have charge of a boiler attached to prime-movers of any horse-power (*or* not exceeding 60 or 20 horse-power nominal, *as the case may be*), is granted under section 15 of the said Act this certificate of competency of the first (or second or third, *as the case may be*) class.

The of 189 .

(Signed) ,
Board of Examiners.

Duplicate of this certificate has been recorded in the office of the Inspector of Steam-boilers and Prime-movers this day of 189 .

(Signed) ,
Inspector of Steam-boilers and Prime-movers.

Form of Certificate to be granted under section 17 of the Act.

No. of 189 .

Whereas Mr. , at present residing at , has produced before us a certificate of the class issued to him by the , we, in accordance with the provisions of the Madras Act III of 1893, section 17, hereby authorize him to be in charge of boilers attached to prime-movers of horse-power on the production of this certificate.

The of 189 .

(Signed) ,
Board of Examiners.

Duplicate of this certificate has been recorded in the office of the Inspector of Steam-boilers and Prime-movers this day of 189 .

(Signed) ,
Inspector of Steam-boilers and Prime-movers.

Form of Certificate of Service.

CERTIFICATE of service of the class granted under section 18 of Madras Act III of 1893.
No. of 189 .

A.B., aged about , at present residing at , having satisfied the Board of Examiners appointed under the above Act at , that he has served for a period of not less than three years prior to the day of (the date on which the rules under the said Act published in *Fort St. George Gazette* of came into force) as Engineer in actual charge and management of a boiler, and that he is possessed of competent skill for the charge of a boiler attached to prime-movers of any horse-power (*or* not exceeding 60 or 20 horse-power nominal, *as the case may be*), is granted under section 18 of the said Act this certificate of *service* of the first (or second or third, *as the case may be*) class.

The of 189 .

(Signed) ,
Board of Examiners.

Duplicate of this certificate has been recorded in the office of the Inspector of Steam-boilers and Prime-movers this day of 189 .

(Signed) ,
Inspector of Steam-boilers and Prime-movers.

APPENDIX C.

Examination in rough working drawing for a first-class Engineer's certificate of competency.

1. Rules in regard to the qualifications of a candidate for a first-class Engineer's certificate of competency specify that—

"He must be able to make rough working drawings of the different parts of the engines and boilers;

"He must be able to state the general proportions borne by the principal parts of the machinery to each other."

2. In accordance with these clauses a candidate for a first-class certificate is required to make a rough working drawing of the parts specified below:—

Fine drawing is not expected and in the proportions of the parts a wide margin will be allowed; grossly inaccurate dimensions will be failure in practical knowledge. The drawing must, however, be practically a working drawing, giving a sufficient number of views to show the parts fully—sections, plans, or elevations—just as the candidate would require to be supplied to him if he had to make the parts to the design of another person.

3. A clear hand sketch showing the construction completely and fully dimensioned will be accepted if the candidate prefers this alternative.

4. A portion only of the parts specified may be accepted in place of the whole, if that portion is sufficient to show that the candidate has a good practical idea of the construction of the parts and a fair notion of their general proportions or dimensions.

5. Candidates are hereby cautioned to put on paper nothing which they have not fully considered and understood.

6. The candidate is advised not to begin more than he can clearly finish in the time allowed. An important object in this part of the examination is to ascertain whether the candidate can be trusted to mark all necessary dimensions upon a sketch or a drawing. The test of this is practically the making of the part from the sketch without having to supply additional dimensions and without measuring the drawing. To prove his ability the candidate must fully dimension the parts shown in his sketch or drawing notwithstanding that the parts may be correctly drawn to scale. A drawing is fully dimensioned when no part of it is left to the option of the party who is to work the drawing.

7. The candidate is not expected to design anything; he has merely to sketch or draw something with which he is already familiar.

8. All the dimensions, the figures, and the darts must be inked in; employ the remaining time in examining the drawing and in inking in any figures which may have been before overlooked and in checking the dimensions.

9. There should be sufficient room on the sheet to show all the necessary views. Another sheet of paper can be had if necessary. All the paper used must be forwarded with the drawing.

Fill in and sign the following statement:—

Subject for Examination in Rough Working Drawings.

Specimen Questions.

A common slide valve with its spindle? Show also an outline section of the parts at the cylinder face? Show the provision for connecting the slide valve to the spindle?

The candidate is requested to fill up the following and to attach this paper to his drawing:—

Statement by the Candidate.

The accompanying drawing, made by me this day, without referring to any document and without the assistance of any person is intended by me to be sufficient for the new construction of the parts above described to fit the place of similar parts which are to be removed. The construction is similar to what I am familiar with in the . Factory, Mill or Workshops , but the dimensions may be different.

Specimen notes on Drawing.

The diameter of the cylinder is .
The stroke of the piston is .
The stroke of the valve is .

The cover at top end on steam side is .
The cover at bottom end on steam side is .
The lead at top is intended to be .
The lead at bottom is intended to be .
The inside cover is or .
The thickness of the face of valve is .
The thickness of the body of valve is .
The greatest opening for steam will be .
That gives an area equal to one .
The opening for exhaust when the crank is on the top centre is .
That gives an area equal to th of piston.
The length of the connecting rod is .
The valve will cut off steam on the down stroke at . } The candidate may omit this part if he chooses.
The valve will cut off steam on the upstroke at . }
The parts fully dimensioned, in ink, are .

Dated at
this day of 189 .
Applicant.
.....

APPENDIX D.

Instructions to Examiners.

Examiners shall require all candidates to fill up a form of which a copy is attached, and they shall forward the same to the Sanitary Engineer along with the reports of the examination (Appendix A).

For the present the questions for candidates for first-and second-class Engineer's certificates will be taken from the book of "Elementary Questions"; and candidates are expected to show their superiority by giving answers more complete than those of the other candidates.

The numbers of the questions for each examination are not to be communicated to the candidate until his examination commences.

The questions themselves need not be written, only the answers to them.

Form of Preliminary questions to be answered by the first-and second-class candidates.

City.	Class for which examined.
Date.	Candidate's name.

(*a*) Where and how long did you serve in works at the making or at the repairing of engines and in what capacities?

(*b*) How long have you served as fireman or driver?

(*c*) How long have you served in an engine-room and in what capacities?

(*d*) With what descriptions of engines have you served—jet condensing, surface condensing, or non-condensing engines, compounds, triples, inverted cylinders, or horizontal engines? What size were the engines?

(*e*) With what descriptions of boilers have you served—Lancashire, marine, multi-tubular, sectional or locotype boilers?

(*f*) What engine defects have come under your notice, what caused these defects, and how were they remedied? Give the names of the factory for verification.

(*g*) What boiler defects have come under your notice, what caused these defects, and how were they remedied? Give the names of the factory for verification.

ELEMENTARY QUESTIONS.

1. What parts of an engine are generally made of wrought iron?
2. What parts of an engine are generally made of cast iron?
3. For what part of an engine is steel sometimes used?
4. What parts of an engine are generally made of brass or gun metal?
5. Where is "white metal" sometimes used? On account of what property possessed by it is it adopted? What objection is there to its more general use?
6. For what parts is Muntz Metal sometimes used? Is it malleable? For what properties is it valued?
7. What difference is there in the composition of cast iron, of wrought iron, and of steel?
8. How can cast iron, wrought iron, and steel be distinguished from each other?
9. What are the different properties of cast iron, of wrought iron, and of steel?
10. What is meant by the terms "breaking stress," "proof stress," "safe working stress"?
11. What is the cohesive strength, or breaking stress, of good ordinary wrought iron?
12. Tempering steel; how is it done, and in what order do the colours come?
13. What is case-hardening?
14. Which of the common metals or alloys can be forged, and which of them are brittle or "short"?
15. What is meant by "welding"? Which of the common metals can be welded?
16. The expansion of metals by heat; give examples of this in the engine and in the boiler.
17. In the construction of cylindrical boilers, what parts of the plates have to be worked hot? When the material is steel, what precautionary treatment of the plates is afterwards necessary?
18. What is "double rivetting"? In what parts of cylindrical boilers is double rivetting employed? In which of the shell seams is it most necessary?
19. What is "caulking," and how are seams prepared for caulking?
20. Describe the different ways of staying the ends of a cylindrical boiler? What are the merits of and objections to the different plans?
21. What strain per square inch is allowed on boiler stays?
22. Describe a rivetted stay, and state where such stays are commonly used?
23. Where are thin plates to be looked for in a boiler as it wears, and how is the thinness to be detected?
24. How are boiler tubes fixed? What are "stay tubes," and how are they secured?
25. Where is it generally that boiler tubes leak? How is this defect repaired? What are the causes of this leaking?
26. What are the causes of cracked tube-plates? Where are the cracks situated? How are they repaired?
27. What is the difference between a "flash flue," a "split draft," and a "wheel draft"? What classes of boilers are each peculiar to?
28. What is meant by a "fuel economiser"? What is its construction? What valves and cocks are on it? What is the pressure per square inch in it, in comparison with the pressure in the boilers to which it is joined?
29. What parts of the "Loco. type" boilers are first injured by shortness of water?
30. Where are angle irons used in the construction of a Cornish or Lancashire boiler? And where are flanged plates used?
31. Priming; to what causes is it attributed? What means are applied to prevent it? What evils may be produced by it?
32. What causes, and what checks furnace draft, with an ordinary factory boiler?
33. Black smoke is sometimes seen at the top of a factory chimney; what is the cause of this? Is it beneficial or detrimental? Give reasons.
34. A "blast pipe" is fitted to Loco. type boilers, what is its construction? Where is it placed? For what is it used?
35. How is a blow-off cock fitted to Lancashire and Cornish boilers? Why is it not fitted direct on to the boiler shell?
36. Blow-off cocks are sometimes fitted with a double gland; for what purpose is this? Describe how the double gland is formed?

37. Test cocks or water-gauge cocks; where are they placed? At what heights? Must the cocks themselves be at those heights? What provision is made for cleaning these cocks should they ever become choked? When there are no test cocks, how is the height of the water ascertained?

38. What is a "dead-weight" safety valve? Of what are the rubbing surfaces formed? What are its advantages and faults compared with the common lever and weight valve?

39. About what area of safety valve is now required by the Board of Trade? What area was formerly required, and on what ground has that been altered? What is the effect of suddenly opening a safety valve when steam is up? To about what extent do safety valves rise when blowing off without being eased by hand?

40. Spring-loaded safety valves; what advantages have they that are not possessed by dead weight valves? What are the disadvantages as compared with dead-weight valves?

41. Of what pieces does a glass water-gauge mounting consist? How does it act? Where is it placed? At what height? Is it liable to derangement? How is its working tested?

42. Glass water-gauges are sometimes fitted in duplicate; what is the object sought?

43. Describe a Bourdon steam-gauge. Some gauges have an inverted syphon pipe below them; what is its use?

44. On Lancashire and Cornish boilers the steam pressure gauge mounting has usually a small branch closed by a screwed cap; what is this branch for?

45. Do steam-gauges indicate the total pressure of the steam, or only a portion of that pressure? What is the pressure measured from?

46. What is meant by the salting of the boiler? How is this prevented? What is the density of ordinary sea water? How is the density ascertained? What is the difference between the formation of scale and the salting of the boiler?

47. Scum cocks and pipes; how are they arranged? Where are they placed? At what height in the boiler? When are they used? When must they be shut? Neglect of these cocks lead to what dangers?

48. Scale; of what does it consist? Where is it most objectionable? How is it removed? How is its formation prevented? What evil effects are produced by it?

49. What is a salinometer? Of what does it consist? How does it act? How is it graduated? Can it be used at any temperature indiscriminately?

50. What harm may be done through the check valve of one of a set of boilers being defective? How would you work to avoid this harm?

51. How is the leak from a split tube stopped in a Loco. type boiler while under steam? Describe the operation.

52. What is the use of dampers? Where are they fitted to Loco. type, Cornish, Lancashire, and Vertical boilers?

53. If no dampers were fitted to a Cornish boiler, how could the draft be regulated? What inconvenience would arise from the want of dampers?

54. Describe the piston of a steam cylinder, with its different rings and their uses.

55. Cylinder drain cocks; what is their use? There is sometimes a valve upon each cock; what purpose does it serve?

56. Cylinder escape valves; of what do they consist? How protected? How regulated? When are they most needed? To what danger do they expose the engineer? What precaution is sometimes used to obviate this danger?

57. What is a "compound engine"? What different kinds are there used in mills and factories, in respect to the number and arrangement of their cranks and cylinders? What is a triple expansion engine?

58. What is "link motion"? What are some of its advantages? What motion is sometimes used in its stead?

59. What is a separate expansion valve? Why is it not fitted to all engines? What effect has an expansion valve upon the starting and upon the reversing of the engine?

60. What arrangement is applied to reduce the friction of a slide valve? To what is the friction due?

61. Describe a "variable-eccentric"? How does it act? In what class of engine is it used?

62. What is the travel of the eccentric? How is it measured on the eccentric? What is the travel of the slide valve when the link motion is in mid gear, and the engine still moving?

63. What are "double beat valves"? Why are they not generally used for safety valves? Are they ever used instead of the slide valve? What objections are there to their use?

64. What is a circulating pump? Is it always worked by the main engine? Give an example from the last factory you worked in, of the three water temperatures generally noted by careful engineers.

65. An air valve is sometimes fitted to a circulating reciprocating pump; what purpose does it serve?

66. What is the difference between a bucket air-pump, a piston air-pump and a plunger air-pump?

67. Whether are double acting air-pumps, made with plungers, with pistons or with buckets?

68. What is an air-pump trunk? When is it necessary? How is it attached to the bucket?

69. What class of air-pump requires both foot and delivery valves, and in what other class can either of these valves be in some cases dispensed with?

70. When working at ordinary speed, when the air-pump bucket is at top of its stroke, at what height is the water in the condenser?

71. With a surface condenser and a single acting air-pump, what is the effect of a leaky foot valve, and what is the effect of a leaky bucket when there is also a foot valve?

72. Air-pump pet cock or valve; where is it placed? How does it act? What is its object? Does it in every case reduce the effective capacity of the pump? Is it equally applicable to double acting pump?

73. At what temperature is the hot well worked? What is the effect of higher temperatures? What is the effect of lower temperatures? What limits the lowness of temperature? Has a very low temperature any disadvantages?

74. Jet fittings to the surface condensers; what are required? When to be used? What precautions are necessary?

75. With surface condensers, what takes the place of the injection? To what is the connexion made? How is its valve formed? Why is this necessary?

76. What are the practical guides to the proper amount of opening of the inlet valve for the circulating pump?

77. Feed-pump pet cock or valve; where is it placed? What is its use? How does it act? Is it always a necessary fitting?

78. What are some of the ways of fastening the ends of surface condenser tubes? About what size and about what thickness are condenser tubes? What parts of a surface condenser are made of brass?

79. What is a blow-through valve or cock? To what is it attached? There is sometimes a valve that when opened admits steam from the slide valve casing to the exhaust port; what is its use? To which cylinder is it fitted?

80. What is a "Hopkinson valve"? What is its use? Where is it fixed? How is it set? Can it be set too low or too high?

81. What connections are generally fitted to the donkey pump, and to what services can it be applied?

82. When the engines are stopped with steam up, what are to be shut and what are to be opened?

83. How is an engine heated up before starting? What precautionary examinations are made before starting?

84. What is an interceptor or catch-water? Where is it fixed, what is its construction, how does it act, and what attention does it require?

85. Describe an air-pump bucket, with its valve or valves and its packing. Of what are the valves generally made?

86. Of what materials are air-pump rods made? Why so?

87. What is meant by "unsteady driving"? Mention instances. What danger attaches to it? What is done to prevent it?

88. What are governors? What is their general construction? How do they act on "Corliss valves"?

89. What is meant by "spur driving," "rope driving," and "pelt driving"?

90. Explain the difference between a right hand and a left hand engine?

91. What is meant by the "Slip" of a belt or a rope on a driving pulley?

92. Which of the valves about engines and boilers have to be worked by hand, which of them work self-actingly, and which are worked by the motion of the engine?

93. Why is soda sometimes put into a boiler, and how is it put in? What is the kind of soda used?

94. Tallow cups for cylinders were sometimes made with two small cocks, or with only one small cock, or with one large hollow plug cock, or with one small cock and a valve; which of these is suitable for a high pressure cylinder, and which for the cylinder of a condensing engine? Describe how the cup with only one small cock is used? What is now generally used instead of these? How has this change come about?

95. Does a cylinder escape valve, self-acting, allow all the water to escape, if not, how much is left in the cylinder?

96. What is a "sight feed" lubricator? Explain its action. To what part of an engine is it generally attached? Whether will throwing cold water over it, make it work faster or slower? Describe one you have worked.

97. A common spur driving wheel; what is the boss made of? How are the arms fastened into the boss? How are the weight segments, and the toothed segments fastened?

98. Why have some of the weight segments of a spur wheel hollow spaces in them, while others are solid? With what class of engines is this unevenness most required? In what part of the circumference is the heaviest segment put?

99. With what class of compound engine is a "receiver" required between the high and low pressure cylinder, and with what class of compound engine is such a receiver unnecessary? State reasons in each case.

100. Explain the terms, "spur gearing," "bevil gearing," "mortise gearing," and "friction gearing," stating in what cases each is used.

101. What is meant by "staking" a wheel or drum? And what is meant by the term "hung on keys"?

102. What is meant by "pitch line" of a toothed wheel? What is meant by "pitch," length and width of teeth on spur wheels?

103. Explain the terms "spring pinion" and "split drum," why are they so made?

104. What valve motion is used for regulating the admission of steam to the cylinders of mill-engines? Explain the principle of its action.

105. What are expansion joints? Where are they necessary? What attention do they require? Of what should the working surfaces be made?

106. What omission in the construction of expansion joints may lead to a serious accident when steam is first applied? Where are such joints most required? Describe several forms of expansion joints.

107. Describe an oil cup with a syphon worsted. How is the worsted arranged? How is it cleaned? How far down the tubes does it extend?

108. Describe a main shaft bearing (with its system of adjustment and lubrication) of a rope driving mill engine, compound cranks at right angles, to indicate 1,000 H.P.

109. What is the usual speed of ropes, and what indicated H.P. does each rope usually drive, in ropes 5½ inches circumference driving spinning mills?

110. Describe a Jacketted "Corliss" cylinder with all necessary fittings.

111. In mill-gearing, what is meant by a "foot step"? Where are such used?

112. How are heavy wheels fixed to their shafts? What prevents them working loose?

113. Where are injection valves placed in jet condensing factory engines? From what position is this valve usually worked? Why so? What attention does it require?

114. In an ordinary factory, fitted with compound engines and Lancashire boilers, what cocks and valves are in the engine room, and what are in the boiler house?

115. Describe the necessary fittings of a Lancashire boiler, including an Injector.

116. With a surface condensing engine, what cocks or valves are opened some time before the engine is started so as to be ready for starting whenever the order is given?

117. What is a steamjacket? What cocks are on it? In what engines are jackets most generally used? Do they require to be felted?

118. What parts of an engine or its fittings should be felted or otherwise protected from radiation?

119. The work of the air pump in a mill engine is usually done, driving one stroke of the engine; which stroke is so burdened, and why?

120. Name the principal pipes about the engines and boilers of a cotton mill, and state to what the ends of such pipes are connected.

121. Through what cocks or valves, pipes and chambers does the water pass on its way from the "jack well" to the water space in the boilers with a jet condenser engine?

122. Through what cocks or valves, pipes, and chambers does the circulating water of a surface condenser pass?

123. Through what cocks or valves, pipes and chambers does the steam pass from the boiler until it is in the form of water in the hot well?

124. Name the pieces of the engine through which the pressure of the steam is transmitted from the piston to the driving gear in an ordinary factory engine?

125. What is an air vessel? How does it act? At what parts of an engine or of its fittings are air vessels generally applied?

126. What is the construction of an injection pipe "foot valve," such as are fitted in jack wells of mill engines? What is their object? Why is the rose fitted below them?

127. What is a "barring engine"? Why are they fitted?

128. What is an oscillating engine? Where are they used? Why? Why are they not used on land?

129. What "reversing motion" is fitted to portable engines having no link motion?

130. What is "Cowburns group" dead-weight safety valve? What are its advantages over the common dead-weight valve?

131. Where are "expansion-couplings" required in shafting? Describe one.

132. Describe a "gusset stay;" show how they are secured to both shell and end plate; state what you know for and against their use in Lancashire boilers.

133. About how much fuel per indicated horse power per hour is required by modern steam engines, common, compound, and triple expansion?

134. What is the explanation of the economy of the surface condenser?

135. What is the construction of a surface condenser? Of what are its tubes made? How are they fixed? How are they kept tight? What is done with a split tube?

136. Where do surface condensers foul? How are they cleaned?

137. What non-conducting substances are employed to prevent radiation, and how are they applied?

138. With "portable engines," what provision is made to prevent ashes and sparks injuring adjacent property?

139. How can the formation of black smoke be prevented? Describe smoke preventing apparatus.

140. What is meant by "circulation" in a boiler, and what are the results of defective circulation?

141. What means are sometimes adopted to improve the circulation in a boiler?

142. How can extra heating surface be gained in Lancashire and Cornish boilers? Is it on the whole advantageous?

143. What "fittings" are usually on a steam receiver between a high pressure and low pressure cylinder?

144. What is the construction of a feed escape valve, to what is its discharge connected, and how is its loading regulated?

145. When there is no feed escape valve, what is the arrangement of the feed valves or cocks?

146. What is the measure of a horse power? How is indicated horse power ascertained?

147. Has "nominal horse power" a fixed meaning? What is the use of this expression? What is generally taken as the measure of one horse power nominal?

148. What is meant by "back-pressure" in a cylinder? About how much was it the last engine you were with? Is excessive cushioning ever a trouble under certain conditions in modern engines? Say when and why, and in which cylinder this occurs.

149. What is meant by "piston-speed," and about how much is it in mill-engines, and how much in non-condensing factory engines?

150. What is "atmospheric pressure"? What is its average amount? What instrument tells this amount?

151. What is "gross pressure" or "absolute pressure"? What pressure is it that is shown by the steam gauge?

152. What is meant by "cutting off" steam? How is it done? What part of the valve regulates the cut off?

153. What is a "Corliss valve"? Describe its construction. Why has it superseded the slide valve for mill engines? What is its great defect?

154. What fixes the time of closing the exhaust? After the exhaust is closed and before the port opens for steam, what becomes of the steam that is in the cylinder?

155. What is the "lead" of the valve? What is its object? About what amount is it?

156. What is the "cover" or "lap" of the valve? What is its object? About what proportion of the stroke of the valve is it made?

157. What is the "exhaust cover" of a slide valve? What is its effect upon the cushioning and upon exhaust?

158. What is "minus cover" or "minus lap" on the exhaust? What is its effect upon the exhaust and upon cushicning?

159. What is "cushioning" or "compression" in a steam cylinder? How is it affected by the amount of cover or of minus cover there may be upon the exhaust? How is it affected by the exhaust pressure?

160. What is "mean effective pressure"? How is its amount ascertained?

161. What is a dial vacuum gauge? What is its construction? For what is it used? About what amount should it show when the engine is working all right? What effect has the variations it indicates on the performance of the engine?

162. Does the vacuum gauge enable you to tell what pressure there is in the condenser, or must you have recourse also to the barometer to arrive at that? How would you ascertain the actual amount of back pressure there is in the condenser?

163. What is a barometer? What is its construction? Is a barometer sometimes used instead of a vacuum gauge? In what respect does the weather barometer differ from the vacuum gauge barometer?

164. The common vacuum gauge and the common steam gauge, in which of them are the graduations marked from atmospheric pressure? Does either of them tell what is the true actual pressure in the boiler or in the condenser?

165. Do steam and vacuum gauges vary with the variations of the weather barometer? When the weather barometer varies from 29 to 31, how much will the vacuum gauge vary, and how will that affect the working of the engine? Why so?

166. Vacuum is generally stated as so many inches. What is meant by, say, 20 inches vacuum? What does that tell us about the absolute pressure of the vapour then in the condenser?

167. From what depth will a pump draw water? Is there any limit? Why?

168. What is vacuum? Can any vacuum move a position? When the temperature of the water in the condenser is 2120, what is the greatest degree of vacuum there can then be in the condenser?

169. What is a thermometer, its construction? What is the property of matter that is the principle of its construction? What temperatures are regularly noted by careful engineers?

170. What is the temperature of (1) melting ice, (2) of boiling water, (3) of steam about 60 lb. pressure by the steam gauge, (4) of steam about 100 lb., and (5) of steam about 150 lb., also (6) of smoke in the funnel, and (7) of water in the hot well?

171. What is meant by the "conduction" of heat? Give examples of it in the boiler and in the engine.

172. What is meant by the "convection" of heat? Give examples of it in the boiler and in the engine.

173. What is meant by "radiation" of heat? Give examples of it in the boiler and in the engine.

174. Which is convection, which is radiation, and which is conduction in the following cases:—(1) Heat from the glowing fuel to the furnace crown. (2) Heat passing from one side of the furnace crown plate to the other. (3) Heat passing from the steam pipes in the engine room. (4) The heat of evaporation?

175. What are the "effective heating surfaces" of a "Lancashire boiler," a "Loco. type boiler," and a "Vertical boiler"?

176. What is the average difference between the temperature of the feed water on entering and leaving an ordinary mill fuel economiser?

177. What is the general temperature of the gases at the base of the chimney attached to a range of boilers in a cotton mill?

178. State as many ways as you can by which a boiler might not get its full speed; that is, a boiler, or one of a set of boilers, gets short of water although the feed valve is open its proper amount; to what causes might this be due?

179. Of what are furnace bars generally made? About what thickness are they at top? About what space is between them? Whether are the bars put further apart for Newcastle coal or for Welsh coal?

180. Which burns faster, Newcastle coal or Welsh coal? Which is the flaming coal? Which makes most smoke?

181. About how many tons of steam coal will be burnt per day in four furnaces, each 3′ 0″ wide, and of about the usual length? On what grounds do you say so?

182. About how many tons of coal will be burnt per day with good compound engines indicating 1,000 H.P.? On what grounds do you say so? What percentage of coal would be required with the same load if the piston speed was augmented five per cent.?

183. About how many tons of steam coal will be burnt per day with a good compound engine, surface condensers, the low pressure cylinder 70 inches diameter doing average work? On what grounds do you say so?

184. A pair of inverted cylinder direct acting engines, there is a liner half an inch thick between the head eccentric rod and the eccentric strap, in overhauling the engine this piece is lost and forgotten; what difference will its omission make in the working of the engine, on the admission, on the cut-off, and on the exhaust of the steam? Which will take place earlier and which later, distinguishing between the up stroke and down stroke?

185. With a horizontal engine with the fly wheel running in the usual direction, which crosshead guide gets the most strain? And on which stroke is the strain greatest? Sketch your meaning.

186. The "toothed segments" in a spur driving wheel are getting loose; how will this show in the engine room?

187. How can you prove whether the main shaft is true with a line through the cylinder?

188. How can the fairness of a pair of bevil wheels be tested? Explain how they are adjusted.

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From the Sanitary Engineer to Government, dated 4th October 1898, No. 1429.

ORDER—No. 2702 W., dated 17th October 1898.

Section 14 of the Madras Steam Boilers and Prime Movers Act, 1893, provides that, from a duly specified date and within any defined local area, no boiler shall be used unless it is in the direct and immediate management of a person certified under the Act to be competent for the charge thereof. The Government having directed inquiry to be made as to how best these provisions could be brought into effect, the Sanitary Engineer now submits detailed proposals with draft rules under sections 14 to 20 and 23 (*c*) (*d*) of the Act.

2. These rules, which are based on those in force in Bombay, provide for three classes of certificates, the lowest of which will be granted on passing a *viva voce* examination of a very elementary character. The second or intermediate certificate requires a somewhat more advanced standard of competency, while to obtain a first-class certificate the candidate must have a well-grounded knowledge of the construction and working of steam engines, and of other allied subjects, including mathematics.

3. It is proposed to make the examinations compulsory eighteen months after the issue of the rules, and the question is raised whether the rules should not be extended to the whole Presidency. The Sanitary Engineer does not recommend that the provisions of the Act relating to the *examination* of boilers should be so extended; but only that the boilers in the mofussil should, equally with those in the town of Madras, be in charge of certificated men.

4. The question as to whether the provisions of the Act relating to the examination of boilers should be extended to the mofussil is being separately considered. Meanwhile, the proposed rules for the grant of certificates of competency, as amended in a few verbal particulars, will be referred to the Locomotive Superintendent of the Madras Railway and General Superintendent, Public Works Workshops, for opinion. Copies of the rules will also be communicated to the Collectors of districts for circulation, through owners of boilers, to the men affected. The Sanitary Engineer will arrange for a similar distribution at Madras.

5. The replies will be considered on or after the 1st January next.

6. A copy of these proceedings will be published in the Fort St. George and District Gazettes for general information.

(True Extract.)

Under Secretary to Government.

To all Collectors.
" the Judicial Department.
" the Local and Municipal Department.
" the Sanitary Engineer.
" the Locomotive Superintendent, Madras Railway.
" the General Superintendent, Public Works Workshops.
" the Superintendent, Government Press.

Exd. S. J. Pereira.

A
From orders
Ind Govt

P W DEPARTMENT

Papers to be read in Proceedings:—

Again G.O., dated 189 , No.

Again G.O., dated 189 , No.

Current No. 7045 of 1898, dated 19th August , from the Sanitary Engineer to Govt.

" 8306 " 1898, " 4 Oct - " " — do — No 1429

" 189 , " " "

Govt Order

ORDER. No 2702 W 17.10.98

Section 14 of the Madras Steam Boilers and Prime-Movers Act, 1893, provides that, from a duly specified date and within any defined local area, no boiler shall be used unless it is in the direct and immediate management of a person -- certified under the Act to be competent for the charge thereof. The Government having directed inquiry to be made as to how best these -- provisions could be brought into effect, the Sanitary Engineer now submits detailed proposals with draft rules under Sections 14 to 20 and 23(c)(d) of the Act.

2. These rules, which are based on those in force in Bombay, provide for 3 classes of certificates, the lowest of which will be granted on passing a viva voce examination of a very elementary character. The second or intermediate certificate requires

48

1 Reminder issued 2-1-99.

W Please enforce amendments if any in the rules issued with G.O. dated 27.8.1898.

[P. W. 4. 500—17-6-98.]

requires a somewhat more advanced standard of competency, while to obtain a first class certificate, the candidate must have a well grounded knowledge of the construction and working of steam engines, and of other allied subjects, including Mathematics.

3. It is proposed to make the examinations compulsory 18 months after the issue of the rules, and the question is raised whether the rules should not be extended to the whole Presidency. The Sanitary Engineer does not recommend that the provisions of the Act relating to the examination of boilers should be so extended; but only that the boilers in the mofussil should, equally with those in the town of Madras, be in charge of certificated men.

4. The question as to whether the provisions of the Act relating to the examination of boilers should be extended to the mofussil is being separately considered. Meanwhile, the proposed rules for ~~examinations and~~ the grant of certificates of competency, as amended in a few verbal particulars, will be referred to the Locomotive Superintendent of the Madras Railway and General Superintendent, P. W. Workshops for opinion. Copies of the rules will also be communicated

communicated to the Collectors of districts for circulation, through owners of boilers, to the men affected. ~~Notice~~ The Sanitary Engineer will arrange for a similar distribution at Madras.

5. The replies will be considered on or after the 1st ~~December~~ January next.

6. A copy of these Proceedings will be published in the Fort St. George and District Gazettes for general information.

27.5.95

To

All Collectors.
The Judicial Department.
,, Local & Municipal Dept.
,, Sanitary Engineer.
,, Locomotive Superintendent, Madras Railway.
,, General Superintendent, P. W. Workshops.
" Supdt. Govt. Press.

C. No. 7045 of 1898.

HIS EXCELLENCY THE GOVERNOR.
THE HON'BLE SIR HENRY BLISS, K.C.I.E.
THE HON'BLE MR. GROSE, C.I.E.

SUBJECT.

Rules for bringing into force Sections 14 to 20 of the Steam Boilers & Prime Movers Act, 1895.

FOR ORDERS.

Before taking further action in this matter the papers are re-circulated to His Excellency and the Hon. Sir Henry Bliss with reference to the Hon. Mr. Arundel's remarks and suggestions.

2. With regard to the date from which the rules are to be made compulsory, it may be noted that the proposed time is considerably longer than that allowed in Bombay where compulsion was enforced after 11 months. Copies of the rules might be sent to the Collector of each district for circulation to the men affected by them, who are, as stated by Sir Henry Bliss, very few in number, and any case of special hardship which arose from making them compulsory could be considered on its merits. If this was done, there would be little fear of competent men

I have concurred with the Hon. Mr. Arundel's proposal on this point.

J.S.H. 16.9.98

Very well - as the Hon'ble Arundel will put it special attention will be called to the question of the period which should elapse before the Rules become compulsory. If the bodies of persons consulted think 18 months too short a time they will say so.

H.B.

[P. W. 43.
500—27-9-98.]

17.9.98 17.9.98 20.9.98

men being thrown out of employment and it may perhaps be decided to make the rules compulsory 18 months after date of intimation.

3. With reference to the proposal to make the rules form part of the Government Technical Examination Scheme I would point out that Mr. Jones considered the advisability of this course but rejected it 'for many reasons' ~~some~~ of which the following are given in para 5(1) of his letter.

I think Mr. De Winton's objections to this proposal are sound.

H.S.H. 16.9.98

Virgoe
H.S.
19/9/98

(1) The rules are framed with reference to an Act administered by the Sanitary Department.

(2) The licenses must be registered at his office.

To these might be added

(3) By far the greater number of the men affected are probably very illiterate, and only capable of passing the tests prescribed for a third class certificate of competency or a certificate of service for which the examination will be conducted orally in a Workshop. The Technical examination rules do not provide for such an elementary examination.

(4) The Examiners for the tests now proposed may, and probably will be men who would not as a rule be --- selected for the Technical Examinations.

In view of these facts it seems best to make the examination independent of the Technical Examination scheme at any rate at first. When experience has been gained of the class of men applying for examination, and the results of the -- scheme now proposed, it may be possible to bring it into line with the Technical Examination Scheme.

4. The wording of the draft rules will be scrutinised before publication with reference to the remarks thereon of the Hon. Mr. Arundel.

W. 16.9.98

W.

Public Works Department.

2

C. No. 7045 of 1898.

(1) His Excellency the Governor.
(2) The Hon'ble Sir Henry Bliss, K.C.I.E.
(3) The Hon'ble Mr. Grose, C.I.E.

SUBJECT:
Rules for bringing into force Sections 14 to 20 of the Steam Boilers & Prime Movers Act, 1893.

FOR ORDERS.

+ Flag C

On the draft of G.O. No. 1741 W dated 8th July 1898, His Excellency the Governor directed inquiries to be made as to how best the provisions of Section 14 of Act III of 1893 could be brought into effect. This section provides that, from any date notified by Government, no boiler should be used, within any defined local area, unless it is in the direct and immediate management and charge of a person certified to be competent for the charge thereof. The following sections of the Act deal with questions of Examination

× 15 Sections 15 to 20 & 23 (c) (d)

(4) The Examiners for
proposed may, and

[P. W. 43. 500—27-7-98.]
H.C. 5-9-98 R.C. 9-9-98 H.S. W.H. 18-9-98 R 12-4-98

Examinations and granting certificates of competency, and admit of rules being framed by Government with this object.

2. The Sanitary Engineer, who is also Ex-officio Inspector of Steam Boilers, was accordingly called upon for proposals for bringing into force Sections 14 to 20 and 23(d) of the Act. Mr. Jones has now submitted draft rules for bringing these sections of the Act into effect. They are based on the rules in force in Bombay, modified to suit local circumstances. They provide for 3 classes of certificates, the lowest of which will be granted on passing a viva voce examination of a very elementary character. The second or intermediate certificate requires a somewhat more advanced standard of competency, while to obtain a first class certificate, the candidate must have a well

well grounded knowledge of the construction and working of steam engines, and of other allied subjects, including mathematics. For first and second class certificates, written papers will be set in addition to practical Examination.

3. In para 3 of his letter Mr. Jones indicates the main points in which his draft rules differ from the Bombay rules.

4. Para 5 of the Sanitary Engineer's letter makes proposals as to the conduct of the Examinations, and the appointment of the Examiner.

5. It is proposed to make the Examinations compulsory 18 months after the issue of the rules, and the question is raised whether the rules should not be extended to the whole Presidency. Mr. Jones does not recommend that the provi-

sion

provisions of the Act relating to the Examination of boilers should be so extended, but that only the boilers in the Mofussil should, equally with those in the town of Madras, be in charge of certificated men.

6. The question as to whether the provisions of the Act relating to the examination of boilers should also be extended has been separately raised by the Hon. Sir Henry Bliss, and the requisite information for the consideration of the matter is now being collected. It must be N.S. well, perhaps, to await a decision in this point, so that the whole matter may be finally settled simultaneously.

7. Meanwhile, the proposed rules which seem comprehensive & suitable, might be sent to independent authorities for opinion. Say the Secretaries Supdt. of the Madras Railway, & the Genl Supdt. P. W. Workshops

5.9.98

I think this may be done. I would suggest, however, that it is a mistake to fix the time by which the Examinations will become compulsory, at 18 months. The time seems too short; the public will hardly get to know them within that time, and probably but few people will have taken advantage of them. Mr. Jones seems to admit this himself, for, though in his letter No. 1279, of 19 Aug. he recommends 18 months, he makes a suggestion for getting round the Rule. He would rate have done that had he not felt that 18 months is really too short a time. I would, for the present, adhere

the Rules to be observed. I would give a warning at the same time that they would be made compulsory, as soon as experience had shown that they work satisfactorily.

A.S.P.
7.9.98

Mr. Jones seems to have worked this matter out very well.

As regards the application of the rules to the city of Madras only, I think we should require the Municipal Municipalities which have steam pumps to employ only certificated men. But we can do this by executive order, if the Act generally is not extended to the Mofussil.

As regards making the rules optional in this first instance, there is no provision for this in the Act. If therefore this course is determined on, we had better, for the present, establish this series of examinations as a part of the Govt. Technical Examn. scheme. I think however, that if as long as 18 months notice is given, the Rules may as well come under the Act & be compulsory. The men who are employed or required won't be those who employ, for they can get certificates of service on easy terms, & the people who employ them are of such a class that they will not fail to acquaint themselves with the rules. Besides, they are so few in number as to be well known that a copy of the rules might be sent to each of them for a very small expenditure. This would be the case that the Public will have to acquire info.

HS
9/9/98

As far as the City of Madras is concerned I should think that 18 months notice wd. be sufficient. But as the draft rules are first to be published for discussion the draft notifn might run " ... H.E. the G. in C. proposes to notify that after a future date

6

to be hereafter fixed which will not be less that 18 months from the date of intimation, no boiler shall &c &c."

Meanwhile as the Hon. Sir H. Bliss notes the rules might form part of the Govt Technical Exam^n scheme. With this view the rules should be sent for criticism to the Director P.I. in addition to the officers named by the C.S. Another reason for this course is that the wording of the Bombay rules & of Mr Jones's adaptation of them is in many cases crude & occasionally ungrammatical. I have noted various minor points in the margin of the rules & append a few comments.

The extension of the Boiler acts to the Mofussil is a matter of much importance. I have known a native firm get a cheap old boiler & use it untested for cotton pressing work with a man in charge little more than a promoted fireman.

Draft Notifn. para 25 (c) (page 10) of

This is from the Bombay rule & is obviously insufficient. The candidate should "be able to show," not "how he would act" but "what ought to be done" in case of breakdown of machinery. He might show for instance that in such a crisis he wd run away home & report that he must perform the annual ceremony of a deceased relative, & this wd satisfy the Exam^r

Wilson 5-2

+ Suggestion subsequently with drawn. Vide letter dated 13/9/98.

Memorandum. 16.9.98

as the rules stands!

para 26 (f) What are the first five rules of arithmetic. Everyone knows the first four. Is proportion the fifth. If so better say "simple proportion".

para 27 (f) for "about" read "approximately".

para 27 (g) omit "creditable"

para 27 (i) the word "as" should apparently be "and".

All through the notifn candidates should, as in the Bombay rules, be called "Candidates for first second or third class certifs"; not "first- second- or third-class candidates."

para 32. It is quite unnecessary to state the elementary fact that a candidate can cross out or "cancel" any part of his work he thinks wrong. What are "additional papers"? apparently sheets of paper are meant. Surely all this is superfluous.

Para 43 a. should be corrected as noted in the margin. The grammatical sense is not what is intended.

Appendix C para 2 nothing is "specified below."

49. Why should there be om declaration at all; and icular why should the swearing escription of the lost certif. to the fact that the lost!

× please see May 4

The second sentence is a general exhortation quite out of place. ~~Do not read aloud~~
For "absurd" read "grossly inaccurate".
Paras 2 & 3 should be merged into one.
Para 6 is ungrammatical & the meaning doubtful.
"Candidates are cautioned not to put on paper what they have not fully considered and deliberately intend to be understood. Do not delib[e]
intend is apparently meant, but the whole para is very clumsy. So is para 7.
Is para 9 in order or a recommn? Compare para 11.
At this seems out of place.
Is the first sentence ~~a repetition~~ of para 13.
See also the other marginal queries.

HA 12.9.98

8

Works

Public (1898) Department.

CURRENT No. 8306

27028

From The Sanitary Engr. to Govt.

Order

No.

Dated 4th October 1898.

Received } 5 — or —.
Registered }

Enclosures 1 (with a file returned)

Spare copies

SUBJECT.

Steam Boilers & Prime Movers Act 1893.

Suggesting certain alterations in the rules of —.

HC
The draft order can now be sent to Press
S.S. 11. Oct 98

25429

BACK PAPERS.

G.O.	No.	Department.	Date.
	1804	P.W.	16-7-98
	1741	"	8-7-98
	5948	"	6-7-98
	1304	"	21-5-98
	1070	"	28-4-98
	640	"	10-3-98
	3104	"	8-11-97
	2826	"	9-10-97

FURTHER PAPERS.

G.O.	No.	Department.	Date.
	1608	P.W.	12-7-97
	1257	"	14-5-97
	1419	"	12-3-97
	215	"	23-1-97
	3490	"	5-12-96
	2162	"	27-7-96
	1661-62	"	4-6-96
	2694-95	"	29-10-95 & file

S. E. 33. 500—18-3-97. № 1429

GOVERNMENT OF MADRAS,

Office of Sanitary Engineer to Govt.,

Fort St. George, 4th October 1898.

OFFICE NOTE

From ~~BY~~

THE SANITARY ENGINEER. to Govt.

To

The Under Secretary to Govt.,
Public works Department.
(Unofficially).

The Sanitary Engineer has no remarks to make regarding the verbal alterations made but begs to point out that further alterations as indicated below are required.

(1) As the rules have been re-numbered, the numbers of other rules quoted in the various rules themselves must also be altered. This has been done and is shewn in the body of the rules by pencil notes in the margin thereof.

(2) In Appendix D the words "for 1st & 2nd class Engineers" should read (as requested by the Honorable Member Mr Arundel) "for candidates for first and second class engineer's certificates". The appendix has been altered accordingly.

(3) As the undersigned's letter № 1277 of 19th August 1898 is apparently to be printed with the rules &c, it will be necessary (since the rules have been re-numbered) that the numbers of certain rules quoted in that letter be altered so as to correspond with the new numbering - this has been done in pencil in the letter and initialled; the alterations should be inked if approved before sending to the Press.

Sanitary Engineer to Govt

Public Works (1898) Department.

CURRENT No. 7045

From

The Sanitary Engineer to Govt.,
Fort St. George.

Order

No. 1277

Dated 19th. August 1898.

Received Rd 22-8-98

Registered 24-8-98

Enclosures 9 ~~Three~~.

Spare copies

SUBJECT.

Madras Steam-boilers & Prime-movers Act III of 1895.

Submitting, with remarks, draft rules for holding examinations for grant of certificates of competency &c., to engine drivers under Section 25 (c) (d) & (e) of the _____

OL 8 334

08/89

BACK PAPERS.

No.	Date.
5948	5-7-98
17418	8-7-98
3104 W	8-11-97
215 W	23-1-97
3490 W	5-12-96
2162 W	27-7-96
2134 W	26-8-95
1804 W	16-7-98
1304 W	21-5-98
1070 W	28-4-98
640 W	10-3-98
3104 W	8-11-97
2826 W	9-10-97
1608 W	12-6-97
1257 W	14-5-97
1419 C	12-3-97
215 W	23-1-97
3490 W	5-12-96
1661-62 W	4-6-96
2694 W	29-10-95
10588	25-8-95
2134 W	26-8-95

No. 2702 with office copy
Genrl. Establishts

FURTHER PAPERS.

No.	Date.

Enclosure to letter No. 1277 of 1898

Public Works Department.

Notification.

In exercise of the powers conferred by section 14 of the Madras Steam-boilers and Prime-movers Act III of 1895, His Excellency the Governor in Council proposes to notify that, after a date to be hereafter fixed which will not be less than ~~after the expiry of eighteen months from a date hereafter to be notified~~ 18 months from the date of intimation, no boiler shall be used within the City of Madras unless it is in the direct and immediate management & charge of a person certified under the above Act to be competent for the charge thereof, and under Section 25 clauses (c), (d), & (e) of the same Act proposes to issue the following ~~draft~~ rules,

(1) for regulating under clause (c) the grant and record of certificates of competency and of service;

(2) for the conduct under clause (d) of examinations for such certificates and for regulating the fees to be charged for admission to the same;

(3) for providing under clause (e) for enquiry into an allegation of drunkenness, misconduct or negligence on the part of the holder of a certificate of competency or service.

2. The Government will consider any suggestions made in respect of these rules which may be received on or ~~before~~ after the first day of ~~January next~~ January 1898

I.- Board of Examiners.

3 The Board of Examiners shall be nominated annually by Government .The examination shall be held at such places as may be notified by Government .Government will nominate not less than three persons to be examiners and shall nominate one of such persons as President of the Board of Examiners; at least two of such examiners shall be Mechanical Engineers in actual practice in the Presidency of Madras.

4 The examiners from time to time nominated above shall receive a fee of Rs 25 per diem for each examination but not less than Rs 50 for each half-yearly examination which he attends from beginning to end.

5 The examiners shall endorse on the printed application of each candidate the result of his examination for a certificate of competency,and shall send to the Sanitary Engineer the the application so endorsed.

II-Examinations.

6 Examinations shall ordinarily be held in the City of Madras twice a year and at intervals of not more than six months. The first examination shall be held six months after the date of the publication of these rules.

7 Every examination shall be attended by one or more clerks from the office of the Sanitary Engineer to Government or the Inspector of Steam-boilers and Prime-movers,who shall do such

such clerical work as may be necessary & shall act as interpreter when required to do so by the Board of Examiners.

6. The examinations shall be of three kinds, one for each of the three classes of certificates of competency which the examiners are hereinafter empowered to grant .

III.- Admission of Candidates to the examinations for certificates of Competency.

A. - General.

7. Candidates at examinations for certificates of competency shall pay fees at the following rates:-

For a 1st.class certificate------		Bs 20
do 2nd.	do ----	Bs 10
do 3rd.	do	Bs 5

8. Unsuccessful candidates will not be entitled to a return of any portion of the fees paid by them; but, if applied for, the fee paid by an applicant, who is not admitted to examination, will be returned to him in full, provided that, in the event of a candidate being unavoidably absent from any examination for which he has paid a fee, it shall be in the discretion of the President of the Board of Examiners to allow him to appear at any examination held within one year of the first examination without a second payment of fee.

9. Any candidate after failure may appear at a succeeding examination for the same class of certificate without payment a further fee on such date as the Board of examiners shall determine

determine under rule 8.10

12 10. Every applicant for examination must make an appli-. cation in the form of Appendix A. He shall duly fill in all the parts of the said form which are to be filled in by a candidate ,& sign the same in the presence of his employer or a Municipal tax-payer of not less than Rs:50 per annum, who shall append his signature in token of attest-ation .The applicant shall then lodge his application at the office of the Sanitary Engineer (Ex-officio Inspector of Steam-boilers and Prime-movers) not later than twenty one days before the date fixed for the examination ,together with—

(a) all testimonials of good character, sobriety ,experience and ability ,together with copies of the same;

(b) any other papers required by these rules or the printed form of application ; and

(c) a receipt from a Government treasury for the amount of the fee prescribed in Rule 9 for the examination at which he wishes to appear;

(d) a letter declaring in what language he desires to be examined.

(e) all previous certificates ,if any, issued to the appli cant under the Act.

13 11. Candidates for certificates of competency who are natives of India must prove to the satisfaction of the Examiners that they can read their vernacular sufficiently well to perform the duties required of them.

B.-Testimonials

12./14 No applicant will be admitted to examination whose testimonial as to sobriety ,experience & ability do not relate to a period of at least 12 months immediately preceding the date of application to be examined,& are not, in the opinion of the Sanitary Engineer, trustworthy and satisfactory.

15 13. The testimonial for any period during which the candidate acted as a chief engineer must be signed by the manager ,owner or secretary by or under whom the candidate was employed & for such period as he acted as a second or lower grade engineer must be signed by the chief engineer,to whom the candidate was subordinate ;but if, for any sufficient reason, the chief engineer signature is not obtainable,it may be signed by the manager, owner or secretary,but the testimonial must declare that the facts stated therein are either in accordance with the reports of the chief engineer ,or,if no such reports are available ,are within the personal knowledge of the person signing the same.

16 14. Testimonials relating to service beyond the limits of British India must be countersigned either by the Consul ,or by some other recognised official authority of the country in which the service was performed or,in the case of the Native State, by the Political Agent:

or must be authenticated by the testimony of some credible person on the spot having personal knowledge of the facts required to be established.

If

~~16.~~ 17 If the Sanitary Engineer has reason to doubt the truth of any fact stated in any application or testimonial he may make such enquiries as he shall think fit.

~~16.~~ 18 The applications & copies of the testimonials referred to in rule 10 shall, before the date of the examination, be forwarded by the Sanitary Engineer to the President of the Board of Examiners with a certificate to the effect that the candidate is eligible for examination under the rules. The original testimonials shall be filed in the office of the Sanitary Engineer and shall, at the close of each examination, be returned to the candidates who presented them if they apply for the same.

C. - Age and Training of Candidates.

19 ~~17.~~ A candidate for a third class certificate of competency will not be admitted to examination, unless he (a) is qualified within the meaning of the rules next following as a candidate for a second class engineer's certificate of competency, or unless he (b) proves, to the satisfaction of the Sanitary Engineer, that, previous to his application, he has been three years employed as a fireman on engines & boilers, or (c) produces satisfactory certificates stating that he has completed a three years' course in the workshops of a recognised college or Institute & during that period has been constantly instructed in the management of engines and boilers.

Training of ~~Candidates for~~ third class ~~certificates~~ ~~candidates~~.

20 ~~18.~~ A candidate for a second class engineer's certificate of competency must be not less than 21 years of age. No candidate for a certificate of this class will be admitted to the examination, unless he proves to the

Age & training of ~~second class~~ candidates ~~for second class certificate~~.

the satisfaction of the Sanitary Engineer that ,previous to his application,-

(a) he has served an apprenticeship for not less than three years to an engineer ,& that, during that time, he has been employed on the making or repairing of engines ;or

(b) he has been employed for not less than three years as a journey-man mechanic in some factory or workshop on the making or repairing of engines; or

(c) he has, for not less than two years, fulfilled the requirements either of clause (a) or of clause (b) as to service or employment, and has ,for not less than one year in addition thereto, served as engineer in charge or assistant engineer in some mill or factory with boilers under steam; (d) having obtained a third class certificate has since been in independent charge of Engines & Boilers for a period amounting to at least two years; or (e) produces a satisfactory certificate stating that he has completed in the workshops of a recognised college or Institute a three years' course & during that period has been constantly instructed in the management of boilers & engines.

19. A candidate for a first class engineer's certificate of competency must be not less than 22 years of age. No candidate for a certificate of this class will be admitted to the examination unless he proves, to the satisfaction of the Sanitary Engineer, that, previous to

Age & training of ~~first class~~ candidates for first class certificates

his application,-

(1) he is qualified as is required by rule 20 in the case of a candidate for a second class engineer's certificate of competency ;and also proves that-

(2) either

(a) he possesses or is entitled to a first class engineer's certificate of service; or,

if he neither possesses nor is entitled to a first class certificate of service,

(b) that he has served

(i)for at least one year with boilers under steam as engineer with a second class engineer's certificate of competency,- or

(ii) for at least two years with boilers under steam as engineer with a second class engineer's certificate of service, or

(iii) for at least one year with boilers under steam as second engineer with a second class engineer's certificate of service & in addition for at least six months as chief engineer with boilers under steam which are by law required to be in the charge of an engineer holding a certificate:

Provided that if an applicant, who is able to satisfy the Sanitary Engineer as to the character of his service, has, in consequence of service abroad, been unable to obtain a second class certificate

certificate of competency or of service ,he may be allowed, if the Sanitary Engineer see fit ,to be examined for a first class certificate of competency or of service although he has not obtained a certificate of the lower grade.

22 ~~20.~~ Any person qualified under the rules hereinbefore contained to appear for examination as a candidate for a certificate of any class other than the third class may be permitted to appear for examination as a candidate for a certificate of any class inferior to that for which he is so qualified to appear as a candidate.

D.- General Rules regarding Service-

13 21. Every candidate, who ~~qualifies for admission to the examination by service from sea service~~ applies for a certificate of Service (Section 18 of the Act), must show by his testimonials that he has been regularly employed in the engine-room as an engineer of a certain grade.

24 22. Service with boilers not continuously under steam shall count as service of half the same length with boilers continuously under steam unless the candidate proves that more than half of such service was actually under steam; and the candidate must show by his testimonials whether the boilers with which he has worked were or were not continuously under steam.

25 23. Service as an engineer means service in those capacities only which afford opportunities of obtaining practical experience as an engineer on engines, boilers & their appurtenances; it does not include service as a fire-man, stoker, donkey-man, greaser, winchman

winchman ,labourer or engineer's steward.

24. Service performed in places where the Act is not in force may be accepted as qualifying service subject to the same rules as those which apply to service performed in places where the Act is in force.

IV .- Subjects of Examination for Certificates of Competency.

26. To be entitled to a third class certificate of competency Third class, a candidate must satisfy the examiners that-

(a) he fully understands the working & management of boilers, the use of the best means of firing for the prevention of smoke, the separate use of gauge glass-cocks ,blow-off cocks,scum-cocks & other appliances;

(b) he is able to some extent to explain the actual working of engines & the separate uses of feed-pumps ,slide-valves, pistons & other appliances;

(c) he is able to show what ought to be done in case of the break-down of any portion of the machinery &c.

26. To be entitled to a second class certificate of competency a candidate -

(a) must give a description of boilers & the methods of staying them together with the use & management of different valves,cocks,pipes & connections:

(b)

(b) must understand how to correct defects from accident, decay & other causes, & know the means of repairing such defects ;

(c) must understand the use of the barometer, thermometer & Salinometer the principles on which they are constructed;

(d) must know the causes ,effects & usual remedies for incrustation & corrosion;

(e) must state how a temporary or permanent repair could be effected in case of a derangement of a part of the m or of total break-down;

(f) must write a legible hand and understa h rules of arithmetic & their application to qu i about consumption of stores & capacities of tanks.

29 27. To be entitled to a first class certificate of competency a candidate must be able to-

(a) make an intelligible hand-sketch or a working drawing of some one or more of the principal parts of a steam engine;and to mark in,without a copy ,all the necessary dimensions in figures,so that the sketch or drawing could be worked from ;

(b) take off and calculate indicator diagrams;

(c) calculate safety-valve pressure & the strength of the boiler shell,stays & rivetting;

---

x See Appendix C

horse-pow h

(d) ~~must~~ pass a creditable examination as to the various constructions of engines in general use & as to the details of different working parts, external & internal , and the use of each part;

(e) state the general proportions borne by the principal parts of the machinery to each other ,& calculate the direct stress ,tortional stress & the bending stress, in round bars and the direct stress & the bending stress in rectangular bars with given loads;

(f) explain the method of testing & altering the setting of the slide-valves, and sketch ~~about~~ approximately what difference any variation in the slide-valve will make in the indicator diagram, and also explain the method of testing fairness of shafts, and of adjusting them;

(g) ~~must~~ possess a ~~creditable~~ knowledge of the prominent facts relating to combustion ,heat & steam-

(h) explain surface condensation, super-heating & the working of steam expansively , the duty of pumps & the direct strains in engines & boilers;

(i) work calculations including the mensuration of superficies & solids & the extraction of the square root, and the application of these rules to questions relating to the power, duty & economy of engines & boilers ~~and~~ to the

(ii) a[illegible] rods ,shafts & levers of the engine.

[illegible]horse-power

V.- Mode of Examination.

28. Every examination shall be of such a nature as to test the practical knowledge of the candidates & to ascertain their competency to manage boilers and prime movers.

Examination to be practical.

29. The examination for third class certificate will be conducted viva voce in the City of Madras & will be held, if possible, in a Workshop, mill or foundry where the candidate's knowledge can be practically tested in the use of the steam vacuum and water gauges.

30. (1) Each candidate for first & second class certificate will in the 1st & 2nd class place be called upon to give written answers within a prescribed time to ten of the "elementary questions" appended to these rules. If the candidate's answers are not satisfactory, his examination will cease, and he shall be declared to have failed.

(2) If his answers to the ten questions are satisfactory, the candidate will be called upon -

(a) if a candidate for first class certificate-

(1) to answer within a fixed time, a paper of 10 questions in arithmetic as specified in clause (i) of rule 29;

(2) to make within a prescribed time a rough drawing of some part of a boiler or engine;

(3) to answer viva voce questions on the subjects specified

(ii) a horse-power

specified in clauses (b) to (h) both inclusive, of rule ~~27~~ 29, and on the papers which may have been set to him.

(b) if a candidate for second class certificate ~~candidate~~ -

(1) to answer, within a prescribed time, a paper of ten questions in arithmetic as specified in clause (i) of rule ~~26~~ 28

(ii) to answer viva voce questions on the subject specified in clauses (a) to (g) both inclusive, of rule ~~26~~ 28 & on the papers which may have been set to h

(3) Answers to written questions must be worked out i presence of at least one of the examiners.

(4) Each candidate's answers to written questions must be given up on the expiry of the time prescribed whether his answers are then complete or not.

(5) If, at the expiry of the time prescribed, the candidate has failed to work out the whole of the questions set to him but the result of the viva voce examination, taken in connection with the answers to such of the questions as he has worked out, satisfies the Examiners that the candidate is competent to take charge in the case of-

(i) a candidate for first class certificate ~~candidate~~, of boilers, whatever their nominal horse-power and in the case of

(ii) a candidate for second class certificate ~~candidate~~, of boilers not exceeding ~~of~~ sixty nominal horse-power

he shall be declared to have passed, otherwise the candidate shall be declared to have failed.

~~53.~~ When a candidate for a certificate fails to satisfy the Board of Examiners as required by these rules, the Board shall fix a period after the expiry of which he may again appear for examination and shall inform him thereof; and the candidate shall not be at liberty to appear again for the examination at any place at which an examination is held under the Act until after the expiry of the period so fixed.

VI. - Rules for the Examination Room.

~~52.~~ Candidates will be allowed, in the time allotted, to ca any part of their work, and, when required, additional ~~papers~~ sheets be supplied by the examiners, but they will not be allowed to work out the problems on a slate or on waste paper. The additional sheets must be attached to and form part of the examination papers to be given in by the candidate.

~~55.~~ The examination in rough working drawing which candidates for ~~1st.~~ first class certificates have to pass under rule ~~27~~ 29 (a) may at the candidates option be applied either to hand sketches clearly dimensioned & complete in the necessary views and sections or to drawings to a scale. Candidates will have to bring with them any drawing instruments they may require.

~~54.~~ A candidate discovered (a) to have taken into the

examination

examination room any book ,paper,document or memoranda of any description ,or (b) copying from or affording ,giving or receiving any assistance or any information to & from ,or communicating in any way with another, during the time of examination, shall be regarded as having failed in his examination, & will be turned back for six months ,in the same manner as if he had failed in the practical part of the examination; but in such case no part of the fees he may have paid for examination will be returned to him.

36 35. If a candidate leaves the room before answering any question which has been given to him ,he cannot afterwards be allowed to answer it,but the Examiner may substitute other questions another question.

VII.- Grant of lower grade certificates in certain cases.

37 36. If a candidate allowed under the proviso to Rule 21 to be examined for a first class certificate though he has not obtained a certificate for a lower grade,or if a candidate already in possession of a certificate of service fail to pass the examination for the higher grade but pass the examination for the lower grade he may receive a certificate for the grade passed ,but no part of the fee paid by him will be returned.

38 37. A candidate who has been permitted to be examined for a first class certificate of competency under the proviso of rule 21 obtaining a second class certificate of competency

competency or a first class certificate of service , and who fails in his examination in practical knowledge ,shall not be re-examined for a certificate of that grade until he has served 12 months as second engineer with a second class engineers certificate of competency as required by the rules.

39 38. If the candidate fails in the examination for the lower as well as for the higher grade of certificate ,he may be re-examined for a second class certificate only subject to the provisions of Rule 33 31.

VIII .- Postponement of Grant of certific in certain cases.

40 39. (1) If, after a candidate has passed his examination ,it is discovered that his services are insufficient to entitle Short service him to a certificate of the grade for which he has passed,such certificate will not be granted to him; but if the Sanitary Engineer is satisfied that the error in the calculation of his services did not occur through any fault or wilful misrepresentation on the candidates part, the Sanitary Engineer shall report the same to the President of the Board of Examiners who may direct the certificate to be issued ,or may allow the candidate to appear for re-examination without payment of further fee,when he has performed the deficient service.

? factor

...in such a case,the applicants services are sufficient

of a b

sufficient to entitle him to receive a certificate of a

lower grade provided as aforesaid he has not wilfully mis

sented the amount of his services, a certificate of such

lower grade may be granted to him but the difference betwe

the fee paid by him for the superior certificate & the fee

payable for the inferior certificate shall not be refunded.

(3) In such a case, when the applicant has by further

service made up the time in which he was found to be ~~short~~ deficient, he

Re-examination may be required, before he can receive the

higher certificate, to be re-examined in all the subject

IX. Surrender of lower grade certificates

41 40. No certificate of the 1st. or 2nd. class shall be g

Holder of lower grade certificate to surrender it before grant of first or second grade certificate.

to the holder of the certificate of a lower grade unless & until the holder has surrendered to the Sanitary Engineer the certificate of the lower grade.

42 41. Every certificate of competency granted under Section 15

to a ~~person~~ ~~portion~~ in possession of a certificate entitling him

thereto under the said section shall be in the form in this

behalf provided in Appendix B, & shall be endorsed on the

certificate of competency by virtue of which such person is

so entitled as aforesaid.

X.- Certificates of Service.

43 42. In order (1) to ascertain that a candidate for a ce

cate under Section 18 of the Act is possessed of competer

ion to

skill for the charge & management

of a bo- -,and (2) to determine what class of certificate he is qualified to hold,the Board of Examiners shall subject him to such practical examination as they in each case think fit.

44 ~~48.~~ Applicants for certificates of service will be charged fees at the following rates:-

First Class ----------	Rs 10
Second Class -------	Rs 5
Third Class -------	Rs 3

A ~~No~~ person having once received a certificate of service shall not be granted a further certificate of service of higher grade but may obtain a certificate of competency of higher grade under rules ~~20~~ 28 to ~~31.~~ 33

XI.- Form of Certificates.

45 ~~44.~~ Certificates of competency & of service shall be in the forms given in Appendix -B,respectively,or to the like effect.

46 ~~45.~~ Applications under Section 17 of the Act for certificates of competency corresponding to foreign certificates in the possession of the applicants,shall be in the form of Appendix A. Each applicant shall duly fill in the form & together with copies of the original foreign certificates in his possession, shall lodge the form with the Sanitary Engineer at least 10 days before a half yearly examination.

Certificates under Section 17

47 ~~46.~~ Holders of certificates of the ~~1st.~~ first class ~~will~~ shall be deemed ~~to be~~ to have capable,as ~~1st.~~ first class engineers ~~of having~~ charge of boilers attached to prime-movers of any horse-power.

Capabilities of holders of certificates

Holders

47.48 Holders of certificates of ~~2nd.~~ the second class shall be deemed ~~to be~~ capable as second class engineers, ~~of having~~ to have charge of boilers attached to prime-movers not exceeding 60 horse-power nominal.

48.49 Holders of certificates of the third class shall be deemed ~~to be~~ capable as third class engineers, ~~of having~~ to have charge of boilers attached to prime-movers not exceeding 8 horse-power nominal-

---

Note- For the purpose of the above rules the following formulae shall be used to determine the nominal H.P-

For Single Cylinder Engines Condensing or Non-Condensing----- $\left.\right\} \frac{S}{10}$

Where S equals the square of the diameter in inches of the Cylinder-

For Compound Engines ----- $\frac{S}{32}$

For Triple Expansion Engines----- $\frac{S}{22}$

Where S = Sum of the squares of the diameters in inches of all the cylinders of an engine.

written

~~49.~~50 Applications for duplicates under Section 20 of the Act shall be lodged with the Sanitary Engineer together with a ~~sworn~~ declaration of the loss of the ~~describing the lost~~ certificate and other documents relied upon by the applicant.

Duplicate certificates how to be ~~made~~ obtained

~~50.~~51 Duplicates of all certificates granted under the Act shall be recorded in the Boiler Inspector's Office, Madras.

Record of Duplicates.

XII- Misconduct of Holders of Certificates.

~~51.~~52 Should it come to be brought to the notice of, the Sanitary Engineer, that any person holding any certificate under Act III of 1895 has, when on duty, been drunk, or has misconducted himself, or been negligent in respect to his duties, he shall, if he deems it necessary, report the facts to Government in order that the matter may be dealt with under Section 19 of Act III of 1895. On any such enquiry having been ordered by Government, the holder of the certificate about whose conduct the enquiry is instituted shall be called on to surrender his certificate to the Sanitary Engineer to be retained by him until Government pass orders on the result of such enquiry & should such certificate not be surrendered within three days from date of receipt of such call, the provisions of clause 2 of Section 19 of the Act will be enforced.

Appendix A.

Madras Act III of 1893.

Application for an Engineer's Certificate of Competency under Section ——

Rotation No.

(a) - Name, &c, of Applicant.

Names at full length. 1	Surname. 2	Permanent address, stating town, street and No. of House and name of person (if any) with whom residing. 3

Date of Birth.			Where born.	
Day. 4	Month. 5	Year. 6	Town. 7	Country. 8

(b). Particulars of all previous Certificates (if any) whether issued in British Possessions or elsewhere.

Number 9	Competency or Service. 10	Grade. 11	Where issued. 12	Date of issue. 13	If at any time suspended or cancelled, state by what court or Authority. 14	Date. 15	Cause. 16

(c). Certificate now required.

Grade. 17	Competency or Service. 18	Address to which it is to be sent. 19

(d). If Applicant has failed in a previous Examination for the Certificate now required he must here state when and where. If he has not failed, he must state so in writing across this Division.

Day. 20	Month. 21	Year. 22	Town. 23	Subjects in which he failed. 24

(e). Declaration to be made by Applicant.

(Take notice.) - Any person who makes, procures to be made, or assists in making, any false representation for the purpose of obtaining for himself or any other person, a Certificate either of Competency or Service will be criminally prosecuted.

I do hereby declare that the particulars contained in Divisions (a), (b), (c), (d) and (f), of this Form are correct and true to the best of my knowledge and belief; and that the Papers enumerated in Division (f) and sent with this Form are true and genuine documents, given and signed by the persons whose names appear on them. I further declare that the Statement (f) contains a true and correct account of the whole of my services without exception.

And I make this Declaration conscientiously believing the same to be true.

Dated at ..... this .... day of ..... 189 .

Signed in the presence of

Signature of Applicant.
Present address.

(f) List of Testimonials and Statement of Service.

(The Testimonials to be numbered consecutively according to the number given in Column 25 below)

No. of Testimonial (if any).	Where employed.	Horse-power of Engines.	Style of Factory.	Service of applicant: Capacity.	Date of Commencement	Date of Termination	Time employed in this Service: Years.	Months.	Days.	Remarks.	Initials of Verifier
25	26	27	28.	29	30	31	32	33	34	35	36
			Total Service								
			Time served for which Certificates are now produced								
			Time served for which no Certificates are produced								

(g) Certificate of Examiner.

Note - The Examiner should fill up Divisions (g) and (h) and in all cases as soon as possible forward this paper to the Sanitary Engineer. If the applicant passes, his Testimonials and previous Certificates if any, must be sent with this paper. The Certificate and the Testimonials will be delivered to the applicant at the Office of the Sanitary Engineer.

Date and place of Examination.		Insert passed or failed in each Column.		Rank for which passed
Date.	Place.	In working out the questions.	In the viva voce Examination.	
37	38	39	40	41

(h) - Personal description of Applicant.

Height.		Complexion.	Finger marks, Personal marks and peculiarities.	Colour of	
Feet.	Inches.			Hair.	Eyes
42	43	44	45	46	47

I hereby certify that the particulars contained in Divisions (g) and (h) are correct.

This form and the Testimonials are returned to the Sanitary Engineer.

This ... day of ... 189 .

Signature of Examiner.

To The Sanitary Engineer and
(Ex-Officio) Inspector of Steam-boilers & Prime-movers, Madras.

Appendix B.

(SeeRules ~~41 & 44~~ 42 45)

Form of Certificate of Competency.

Certificate of Competency of the.....class granted under the Madras Act III of 1895.

No. of 189

A.B., aged about ,at present residing at ,having satisfied the Board of Examiners appointed under the above Act, of his competency to have charge of a boiler attached to prime-movers of any horse-power (or not exceeding 60 or 20 horse-power nominal,as the case may be),is granted under section 15 of the said Act this certificate of competency of the First (or second or Third,as the case may be) Class.

The of 189

(signed)

Board of Examiners.

Duplicate of this certificate has been recorded in the Office of Inspector of Steam-boilers & Prime-movers this-----day of--------189 .

(signed)

Inspector of Steam-boilers & Prime-movers.

Form of Certificate to be granted under section 17 of the Act.

No. of 189 .

Whereas Mr. ----- -------,at present residing at ----------,has produced before us a certificate of the----- class issued to him by the ----------,we,in accordance with the provisions of the Madras Act III of 1895,section 17,hereby authorise him to be in charge of boilers attached to Prime-movers of ----------horse-power on the production of this certificate.

The of 189 .

(signed)

Board of Examiners.

Duplicate of this certificate has been recorded in the Office of the Inspector of Steam-boilers & Prime-movers,this --------- day of -------- 189 .

(signed)

Inspector of Steam-boilers & Prime-movers.

28 SP

Form of Certificate of Service.

Certificate of Service of the class granted under section 18 of Madras Act III of 1895.

No. of 189 .

A.B., aged about ,at present residing at having satisfied the Board of Examiners appointed under the above Act at ,that he has served for a period of not less than three years prior to the -----day of (the date on which the rules under the Said Act published in Fort St.George Gazette of------came into force) as Engineer in actual charge and that he is possessed of competent skill for the charge of a boiler & management of a boiler, attached to Prime-movers of any horse-power (or not exceeding 60 or 20 horse-power nominal, as the case may be),is granted under section 18 of the said Act this Certificate of Service of the First (or second or Third,as the case may be) Class.

The of 189 .

(signed)

Board of Examiners.

Duplicate of this certificate has been recorded in the Office of the Inspector of Steam-boilers & Prime-movers,this -------day of ------189 .

(signed)

Inspector of Steam-boilers & Prime-movers.

D.C.4
10455/95

29 cd

Appendix C.

Examination in Rough Working Drawing for a First Class Engineer's Certificate of Competency-

---

1. Rule in regard to the qualifications of a candidate for a First Class Engineer's Certificate of competency specify that-

" He must be able to make rough working drawings of the different parts of the engines & boilers;

" He must be able to state the general proportions borne by the principal parts of the machinery to each other"

2. In accordance with these clauses a candidate for a first class certificate is required to make a roggh working drawing of the parts specified below- ~~A mechanic who has been some years in charge of engines & boilers ought by this time to have familiarly in his mind the general construction of at least one set of engines & boilers, say that set he was last with.~~ Fine drawing is not expected & in the proportions of the parts a wide margin will be allowed; ~~absurd~~ grossly inaccurate dimensions will be failure in practical knowledge.

3. The drawing must, however, be practically a working drawing, giving a sufficient number of views to show the parts fully - sections, plans, or elevations, just as the candidate would require to be supplied to him if he had to make the part to

to the design of another person.

4.3 A clear hand sketch showing the construction completely and fully dimensioned will be accepted if the candidate prefers this alternative.

5.4 A portion only of the parts specified may be accepted in place of the whole, if that portion is sufficient to show that the candidate has a good practical idea of the construction of the parts & a fair notion of their general proportions or dimensions.

6.5 Candidates are hereby cautioned ~~not~~ to put on paper ~~what~~ nothing which they have not fully considered and ~~deliberately intend to be understood, as their statement of what they know about the construction of any part required~~.

7.6 The statements given in by a candidate may be in themselves, apparently, of little importance but a sample material from which the state of the candidate's knowledge of engines & boilers is to be inferred, every detail which is glaringly inconsistent with a sound knowledge of the use of the part, or in which an essential consideration has evidently been overlooked, is an important element in the description which the candidate is giving of his own qualifications.

8.7 The candidate is advised not to begin more than he can clearly finish in the time allowed. An important object in this part of the examination is to ascertain whether the candidate can be trusted to mark all necessary dimensions upon a sketch

or

or a drawing. The test of this is, practically the making of the part from the sketc[illegible]hout having to supply additional dimensions and without measuring the drawing. To prove this ability the candidate must fully dimension the parts shown in his sketch or drawing notwithstanding that the parts may be correctly drawn to scale. A drawing is fully dimensioned when no part of it is left to the option of the party who is to work to the drawing.

9. To prevent misunderstanding, however, when the candidate has been led into showing more of the details than he has time fully to finish, he should name, in the statements on the other side, the particular parts which he has fully dimensioned.

10. All dimensions should have lines & darts to indicate distinctly the points between which the dimensions are given.

11. Beware of writing cross dimensions upon centre lines or upon longitudinal dimension lines. This is not an order but a recommendation.

8 ~~12.~~ The candidate is not expected to design anything; he has merely to sketch or draw something with which he is ~~expected to be~~ already familiar.

~~Pencil in nothing after 2 o'clock.~~ 9 ~~13.~~ All the dimensions, the figures, and the darts must be inked in; employ the remaining time in examining the drawing and in inking in any figures which may have been before overlooked & in checking the dimensions.

3281

There should be

~~14.~~ 10 ~~Make sure that you will have~~ sufficient room on the sheet to show all the necessary views. ~~You can have~~ a another sheet of can be had paper if necessary. All the paper used must be forwarded with the drawing.

Fill in and sign the following statement:-

Subject for Examination in Rough Working Drawings

specimen questions

A common slide valve with its spindle.3 show also an outline section of the parts at the cylinder face. Show the provision for connecting the slide valve to the spindle.3

The candidate is requested to fill up the following and to attach this paper to his drawing.

Statement by the Candidate

The accompanying drawing, made by me this day, without referring to any document & without the assistance of any person is intended by me to be sufficient for the new construction of the parts above described to fit the place of similar parts which are to be removed. The construction is similar to what

I ~~have been~~ am familiar with in the ---------- Factory, Mill or Workshops ---------- ,but the dimensions may be different.

The

The diameter of the cylinder is -------

The stroke of the piston is ---------

The stroke of the valve is----------

The cover at top end on steam side is -------

The cover at bottom end on steam side is ---------

The lead at top is intended to be-------

The lead at bottom is intended to be---

The inside cover is ⊣--------- or-----

The thickness of the face of valve is---

The thickness of the body of valve is - ---

The greatest opening for steam will be-----

That gives an area equal to one ------

The opening for exhaust when the crank is on the top centre is----------

That gives an area equal to------th. of piston

The length of the connecting rod is----

The valve will cut off steam on the down stroke at

The valve will cut off steam on the up stroke at-

} The candidate may omit this part if he chooses

The parts fully dimensioned, in ink, are--------

Dated at ------

this --------day of ---------189 .

----------Applicant

Specimen to make on drawing

Appendix

Appendix D.

Instructions to Examiners.

Examiners shall require all candidates to fill up a form of which a copy is attached, and they shall forward the same to the Sanitary Engineer along with the reports of the examination (Appendix A)

For the present the questions for ~~1st. & 2nd.~~ Candidates for first & second class engineer's Certificates will be taken from the book of "Elementary Questions"; and candidates are expected to show their superiority by giving answers more complete than those of the other candidates.

The numbers of the questions for each examination are not to be communicated to the candidate until his examination commences.

The questions themselves need not be written, only answers to them.

Form of Preliminary Questions to be answered by the First Class & Second Class Candidates.

City	Class for which examined
Date	Candidate's Name

A 8549

a. Where & how long did you serve in works at the making or at the repairing of engines & in what capacities ?

b. How long have you served as fireman or driver ?

c. How long have you served in an engine-room and in what capacities ?

d. With what descriptions of Engines have you served-jet condensing, Surface condensing, or non-condensing engines, compounds, triples, inverted cylinders, or horizontal engines ? What size were the engines ?

e. With what descriptions of boilers have you served- Lancashire, marine, multitubular, sectional or locotype boilers?

f. What engine defects have come under your notice, what caused these defects, & how were they remedied ? Give the names of the factory for verification.

g. What boiler defects have come under your notice, what caused these defects, and how were they remedied ? Give the names of the factory for verification.

S. E. 6. 1,000—6-12-97.

No. 1277

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 19th August 189 8

From

J. A. JONES, ESQ., MEM. INST. C.E., F.R.S.E.,

SANITARY ENGINEER TO GOVERNMENT,

To

The Secretary to Government,

Public Works Department.

SIR,

In reply to your Memo No. 594.D of 6th. July 1898, I have the honor to inform you that I have drawn up in communication with the Boiler Inspector a set of rules which are, I think, a complete reply to your queries Nos. 1-3 & 4 and with reference to these rules forwarded herewith I proffer the following remarks-

2. The rules are based on the Bombay Rules but in some few particulars are less stringent- A copy of the Bombay Rules is sent for comparison. The rules in many respects have had to be re-drafted owing to offices, different from those in Bombay, administering the Act here- and the rules put forward in this respect are such as seem suitable to the circumstances of Madras Administration; such rules do not, of course, affect the stringency or otherwise of the examinations.

3. The other main points in which the rules differ are (1) in regard to fees, a second chance being given for the same fee to a failed candidate, vide rule 7 Madras and // Bombay- I think this is desirable looking to the class

class of men in Madras who are drivers & who are not as a rule too highly paid; (2) in regard to the examination for second class certificates of competency where conditions (g) & (h) of rule 28(Bombay) are transferred to the 1st.class(proposed Madras rules)- the Boiler Inspector agrees with me in thinking that the amended rules for persons desiring to obtain second class certificates are stringent enough as we have not here the very large number of well qualified men to be found in Bombay and the Bombay rules apparently refer to sea going engineers as well as to engineers of land engines; (3) in regard to certificate of service (proposed rule No. ~~48~~ 48(a)) this has been amended to ensure that a person once having obtained a certificate of service cannot obtain a further one of higher grade but can reach the higher grade by obtaining a certificate of competency on passing the appropriate examination.

4. In other respects the rules are practically those of Bombay & seem suitable to Madras as amended.

Referring more particularly to your queries Nos. 1 to 4-

(1) The rules shew how the examination will be instituted. I considered ~~time~~ whether the examination might not fall into line with the Technical Examinations of Government but it appeared to me, for many reasons but especially because the rules are framed with reference to an Act administered by this department and observing moreover that the licenses must be registered here, that it is advisable to have the examination quite separate.

(2) Provision for the appointment of examiners will be found in rule 1. It will be observed that the Act prohibits the appointment of a Boiler Inspector as examiner and I presume this debars me as Ex-officio Inspector. The persons who would be most suitable for examiners would be Mechanical Engineers such as

1. The Loco: Superintendent, Madras Railway.
2. The Deputy Loco: do do
3. The partners of Messrs. Massey & Co-
4. The Chief Engineers of the Carnatic, Buckingham, Choolay Mills &c
5. The Engineer of Messrs. Oakes & Co- The Engineer of Messrs & Co.
6. The Mechanical Engineer of the Madras Municipality.
7. The Loco: Foremen, Madras & South Indian Railways.
8. The Mechanical Engineer of the Gun Carriage Factory.
9. The do do Arsenal.

The rules provide for two of the examiners being Mechanical Engineers while the third might be ~~a~~ Public Works or other officer or Government. As however it is proposed that the examiners be appointed annually, names could be submitted from time to time.

(3) The proficiency required for each class is regulated by the proposed rules.

(4) The examination should be made compulsory 18 months after date of issue of rules. This will be no hardship because under rules ~~21~~ 23 to ~~24~~ 26 certificates of service can be obtained by all those persons who shall have been for three years in charge of engines when these rules began to operate, that is, they must have 18 months' service before the publication of the rules. The ~~time~~ former period is much longer than was given in Bombay, the notification appearing in November 1874 & the 1st. October 1875 being named as the date after which no person not qualified under the rules should be in charge of a boiler. It is true that such persons have to satisfy the examiners of their capability (vide rule ~~48~~ 43) but it is evident that this rule must be worked with discretion & leniency because men might otherwise be deprived of making a living by the profession they had adopted & which previous to the issue of the rules, no person could prevent them from following -practically every one who had been in charge of boiler and engine for the period stated would be granted a certificate unless he shewed the most gross ignorance & that his continued employment had been due to good luck & not good guidance.

5. I do not think that I need to further remark in regard to the rules as proposed but I would add that I deem it a matter to be considered whether the rules should not be extended to the whole Presidency - that portion of the Act relating to the examination of boilers is in force only in the

the City of Madras & that portion I do not propose should be extended meantime but it would add immensely to the security of person & property if all persons in charge of boilers within the Presidency were certificated. This is a point for consideration by Government.

7. Meantime orders for the issue of the notification re rules proposed might be obtained, as Government would then be able to observe how the proposed regulations were received in Madras itself ; the rules would require slight modification if extended to the Mofussil.

I have the honor to be,

Sir,

Your most obedient servant,

Sanitary Engineer to Govt.