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GOEWERMENSKENNISGEWING.

DEPARTEMENT VAN VERVOER.

No. R. 735.]

[27 Mei 1960.]

MARINE-AFDELING.

REGULASIES IN VERBAND MET—

- (a) DIE VELD EN AFNEEM VAN EKSAMENS WAARIN 'N PERSOON MOET SLAAG WAT DIE TOEKENNING KRAGTENS DIE HANDELSKEEPVAARTWET, 1951 (WET No. 57 VAN 1951), VAN 'N BEKWAAMHEID-SERTIFIKAAT VERLANG, AS—
 - (i) HOOF-INGENIEUROFFISIER; OF
 - (ii) TWEDE INGENIEUROFFISIER;
- (b) DIE OUDERDOM EN KWALIFIKASIES VAN DIE KANDIDATE, ASOOK HUL DIENS TER SEE EN ANDER DIENS WAT HULLE MOET VERRIG HET EN DIE OPLEIDING WAT HULLE MOET ONDERGAAN HET;
- (c) DIE EKSAMENGELDE WAT DEUR KANDIDATE BETAAL MOET WORD; EN
- (d) DIE VORMS EN ANDER DOKUMENTE MET BETREKKING TOT SODANIGE EKSAMENS EN SERTIFIKATE EN DIE BESONDERHEDE WAT DAARIN VERVAT MOET WORD.

Dit het die Minister van Vervoer behaag om, kragtens die bepalings van subartikel (1) van artikel driehonderd ses-en-vyftig van die Handelskeepvaartwet, 1951 (Wet No. 57 van 1951), die volgende regulasies uit te vaardig.

INHOUD.

INLEIDING.

HOOFSTUK I.

ALGEMEEN.

1. Opskrif van hierdie regulasies.
2. Woordbetekenis.
3. Sekretaris moet benoembaarheid van kandidate vaststel.
4. Bewys van nasionaliteit.
5. Plekke waar eksamens gehou word.
6. Aansoekvorm.
7. Ander dokumente wat voorgelê moet word.
8. Oorweging van twyfelagtige gevalle.
9. Aansoeke om inligting.
10. Getuigskrifte.
11. Doofheid en ander liggaams- en geestesgebreke.
12. Onvoldoende diens.
13. Afskrifte van verlore sertifikate.
14. Wangedrag van kandidate.

GOVERNMENT NOTICE.

DEPARTMENT OF TRANSPORT.

No. R. 735.]

[27 May 1960.]

MARINE DIVISION.

REGULATIONS GOVERNING—

- (a) THE SCOPE AND CONDUCT OF EXAMINATIONS TO BE PASSED BY A PERSON DESIRING THE GRANT UNDER THE MERCHANT SHIPPING ACT, 1951 (ACT No. 57 OF 1951), OF A CERTIFICATE OF COMPETENCY AS—
 - (i) CHIEF ENGINEER-OFFICER; OR
 - (ii) SECOND ENGINEER-OFFICER;
- (b) THE AGE AND QUALIFICATIONS OF THE CANDIDATES, INCLUDING THE SERVICE AT SEA AND OTHER SERVICE WHICH THEY MUST HAVE PERFORMED AND THE TRAINING WHICH THEY MUST HAVE UNDERGONE;
- (c) THE FEES TO BE PAID BY THE CANDIDATES FOR EXAMINATION; AND
- (d) THE FORMS AND OTHER DOCUMENTS RELATING TO SUCH EXAMINATIONS AND CERTIFICATES AND THE PARTICULARS TO BE CONTAINED THEREIN.

The Minister of Transport has been pleased, under the provisions of sub-section (1) of section three hundred and fifty-six of the Merchant Shipping Act, 1951 (Act No. 57 of 1951), to make the following regulations.

CONTENTS.

PREAMBLE.

CHAPTER I.

GENERAL.

1. Title of these regulations.
2. Interpretation.
3. Secretary to determine eligibility.
4. Proof of nationality.
5. Places of examination.
6. Form of application.
7. Other documents to be submitted.
8. Consideration of doubtful cases.
9. Enquiries.
10. Testimonials.
11. Deafness and other physical and mental disabilities.
12. Service found to be insufficient.
13. Copies of lost certificates.
14. Misconduct by candidates.

HOOFSTUK II.

A. KWALIFIKASIES WAT VEREIS WORD VAN 'N KANDIDAAT VIR 'N BEKWAAMHEIDCERTIFIKAAT AS TWEEDE INGENIEUROFFISIER EN ENDOSSEMENT.

15. Ouderdom en ander kwalifikasies.

A (1) *Werkswinkeldiens.*

16. Diens as leerling-ingenieur of -vakman.

17. Studente of tegniese leerlingskappe.

18. Voltydse kursusse aan tegniese skole, tegniese kolleges of universiteite.

19. Vergoedende diens.

B (1) *Seediens.*

20. Seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

21. Seediens wat vereis word vir die endossement van 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

22. Soort seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

23. Kwytskelding van seediens vir tweede ingenieuroffisier.

B. KWALIFIKASIES WAT VEREIS WORD VAN 'N KANDIDAAT VIR 'N BEKWAAMHEIDCERTIFIKAAT AS HOOF-INGENIEUROFFISIER EN ENDOSSEMENT.

24. Seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

25. Seediens wat vereis word vir die endossement van 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

26. Soort seediens dat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

27. Kwytskelding van seediens vir hoof-ingenieuroffisier.

28. Eksamen sonder die voorlegging van 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

C. ALGEMENE BEPALINGS WAT BETREF BENOEMBAARHEID.

29. Algemeen.

30. Hoe seediens bereken word.

31. Diens in skepe op kort-seereise, vissers- of sleepbote.

32. Diens verrig by hulpmasjinerie.

HOOFSTUK III.

EKSAMENGELDE.

33. Wanneer betaalbaar.

34. Waar betaalbaar.

35. Tabel van eksamengelde.

36. Terugbetaling van eksamengelde.

HOOFSTUK IV.

EKSAMENS.

37. Eksamen vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

38. Eksamen vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

39. Eksamen vir endossering van sertifikate van tweede en hoof-ingenieuroffisier.

40. Vereiste punte om te slaag.

41. Druip in eksamen.

42. Erkennung van gedeeltelike slaagpunte in eksamens wat in ander dele van die Statebond gehou is.

CHAPTER II.

A. QUALIFICATIONS REQUIRED OF CANDIDATES FOR CERTIFICATES OF COMPETENCY AS SECOND ENGINEER-OFFICER AND ENDORSEMENT.

15. Age and other qualifications.

A (1) *Workshop service.*

16. Service as Apprentice Engineer or Journeyman.

17. Student or Technical Apprenticeships.

18. Full-time Technical Schools, College or University Courses.

19. Compensatory service.

B (1) *Sea Service.*

20. Sea service required of a candidate for a certificate of competency as Second Engineer-Officer.

21. Sea service required for endorsement of a certificate of competency as Second Engineer-Officer.

22. Type of sea service required of a candidate for a certificate of competency as Second Engineer-Officer.

23. Remission of sea service for Second Engineer-Officers.

B. QUALIFICATIONS REQUIRED OF CANDIDATES FOR CERTIFICATES OF COMPETENCY AS CHIEF ENGINEER-OFFICER AND ENDORSEMENT.

24. Sea service required of a candidate for a certificate of competency as Chief Engineer-Officer.

25. Sea service required for endorsement of a certificate of competency as Chief Engineer-Officer.

26. Type of sea service required of a candidate for a certificate of competency as Chief Engineer-Officer.

27. Remission of sea service for Chief Engineer-Officers.

28. Examination without production of a certificate of competency as Second Engineer-Officer.

C. GENERAL PROVISIONS AS TO ELIGIBILITY.

29. General.

30. How sea service is calculated.

31. Service in ships making short voyages, fishing boats or tugs.

32. Service on auxiliary machinery.

CHAPTER III.

EXAMINATION FEES.

33. When to pay fees.

34. Where to pay fees.

35. Table of fees.

36. Refund of fees.

CHAPTER IV.

EXAMINATIONS.

37. Examination for a certificate of competency as Second Engineer-Officer.

38. Examination for a certificate of competency as Chief Engineer-Officer.

39. Examination for endorsement of Second and Chief Engineer-Officers' certificates.

40. Marks required for pass.

41. Failure in examination.

42. Recognition of partial passes at examinations held in other parts of the Commonwealth.

HOOFSTUK V.

HOU VAN EKSAMENS.

43. Kandidate moet stip op tyd wees.
44. Geen vreemdelinge word toegelaat nie.
45. Stilte.
46. Los velle papier en boeke.
47. Gebruik van matematiese tafels.
48. Gebruik van instrumente.
49. Ongemagtigde boeke en geskrifte is streng verbode.
50. Skade aan boeke, instrumente, ens.
51. Uitgaan uit kamer.
52. Alle werk moet vertoon word.
53. Straf vir afskryf, ens.
54. Kandidate kan eie metode volg.
55. Straf vir oortreding van regulasies.

HOOFSTUK VI.

UITREIKING VAN SERTIFIKATE.

56. Magtiging vir lewering van bekwaamheidsertifikate.
57. Uitreiking van bekwaamheidsertifikaat as ingenieur-offisier.
58. Endossering van sertifikaat as tweede of hoof-ingenieuroffisier.

HOOFSTUK VII.

DIENSSERTIFIKAAT.

59. Hoe aansoek gedoen moet word.

BYLAES.

Bylae A.—Lys van vorms wat in hierdie regulasies voorkom.

Bylae B.—Voorbeelde van getuigskrifvorms.

Bylae C.—Leerplanne vir die eksamens van hoof- en tweede ingenieuroffisier.

Bylae D.—Lees van die waterpeilglas.

Bylae E.—Lys van voorgestelde handboeke.

Bylae F.—Voorbeelde van vraestelle.

INLEIDING.

(1) Onderstaande regulasies handel oor bekwaamheid-sertifikaat as hoof-ingenieuroffisier en tweede ingenieur-offisier. Hierdie sertifikaat kan soos volg wees:—

Stoom-sertifikaat waardeur die houters die reg verleen word om diens te doen as ingenieuroffisiere in stoomskepe.

Motorsertifikaat waardeur die houters die reg verleen word om diens te doen as ingenieuroffisiere in motorskepe.

Gekombineerde sertifikaat waardeur die houters die reg verleen word om diens te doen as ingenieur-offisiere in sowel stoom as motorskepe.

CHAPTER V.

CONDUCT OF EXAMINATIONS.

43. Candidates to be punctual.
44. No strangers admitted.
45. Silence.
46. Loose papers and books.
47. Use of mathematical tables.
48. Use of instruments.
49. Unauthorised books and papers strictly forbidden.
50. Damage to books, instruments, etc.
51. Leaving room.
52. All work to be shown.
53. Penalty for copying, etc.
54. Candidates may use own method.
55. Penalty for breach of regulations.

CHAPTER VI.

ISSUE OF CERTIFICATES.

56. Authority for delivery of certificates of competency.
57. Issue of certificate of competency as Engineer-Officer.
58. Endorsement of certificate as Second or Chief Engineer-Officer.

CHAPTER VII.

CERTIFICATE OF SERVICE.

59. How application should be made.

ANNEXES.

Annex A.—List of forms appearing in these regulations.

Annex B.—Specimen forms of testimonials.

Annex C.—Syllabuses for the Examinations of Chief and Second Engineer-Officers.

Annex D.—Reading the water-gauge.

Annex E.—List of suggested text books.

Annex F.—Specimen examination papers.

PREAMBLE.

(1) These regulations deal with certificates of competency as Chief Engineer-Officer and Second Engineer-Officer. These certificates may be:—

Steam Certificates entitling the holders to serve as Engineer-Officers in steam ships.

Motor Certificates entitling the holders to serve as Engineer-Officers in motorships.

Combined Certificates entitling the holders to serve as Engineer-Officers in both steam and motor ships.

(2) Hangende die uitvaardiging van regulasies kragtens artikel vyf-en-sewentig (3) van die Wet om voorsiening te maak vir die uitreiking van bekwaamheidsertifikate van 'n hoër graad as dié van hoof-ingenieuroffisier, is reëlins met die Ministerie van Vervoer van die Verenigde Koninkryk getref om, in Suid-Afrika, kandidate vir sodanige sertifikate, bekend as „Ekstra-eersteklas” te eksamineer. Hierdie sertifikate is vereiste kwalifikasies vir party staats- en professionele aanstellings.

HOOFSTUK I.

ALGEMEEN.

Opskrif van hierdie regulasies.

1. Hierdie regulasies word genoem die Regulasies in verband met die Eksamens vir Ingenieuroffisiere, 1960.

Woordbetekenis.

2. In hierdie regulasies beteken die uitdrukking „die Wet”, die Handelskeepvaartwet, 1951 (Wet No. 57 van 1951) en, tensy uit die samehang anders blyk, het enige uitdrukking waaraan daar in die Wet 'n betekenis toegeken is, wanneer dit in hierdie regulasies gebruik word, die aldus toegekende betekenis, en—

- (1) beteken „goedgekeur” deur die Sekretaris goedgekeur;
- (2) beteken „eksaminator” die persoon wat kragtens artikel sewe-en-sewentig (4) van die Handelskeepvaartwet, 1951, as sodanig aangestel is;
- (3) sluit „perdekrag” in—
 - (a) indikateurperdekrag, waar suierstoommasjiene gebruik word;
 - (b) remperdekrag, waar binnebrandmotors gebruik word;
 - (c) as-perdekrag, waar stoomturbines gebruik word;
- (4) beteken „lang-seereis” 'n seereis waarin die afstand tussen die uiterste hawens wat deur die skip in die loop van die seereis besoek is minstens 500 myl is; en
- (5) beteken „kort-seereis” 'n seereis waarin die afstand tussen die uiterste hawens wat deur die skip in die loop van die seereis besoek is minder as 500 myl is.

[LET WEL.—

(1) Artikel twee van die Wet sluit onderstaande woordbepalings in:—

„kusvaarder”, 'n skip wat gebruik word op reise tussen hawens in dieselfde land, maar dit omvat nie 'n visserboot of 'n robbe- of walvisvaarder nie;

„skip op vreemde vaart”—

- (a) 'n skip wat gebruik word op reise tussen 'n hawe in een land en 'n hawe in 'n ander land; of
- (b) 'n walvisvaarder uitgesonderd 'n walvisvaarder met landbasis;

„Minister”, die Minister van Vervoer;

*„bevoegde beampte”, die beampte wat deur die Minister aangewys is as die bevoegde beampte by die plek en ten opsigte van die saak waarvan melding gemaak word in die bepaling in hierdie Wet waarin die uitdrukking voorkom.

„Sekretaris”, die Sekretaris van Vervoer.

CHAPTER I.

GENERAL.

Title of These Regulations.

1. These regulations are called the Examination Regulations for Engineer-Officers, 1960.

Interpretation.

2. In these regulations the expression “the Act” means the Merchant Shipping Act, 1951 (Act No. 57 of 1951), and unless the context otherwise indicates, any expression used in these regulations to which a meaning has been assigned in the Act, bears the meaning so assigned, and—

- (1) “approved” means approved by the Secretary;
- (2) “examiner” means the person appointed as such in terms of section seventy-seven (4) of the Merchant Shipping Act, 1951;
- (3) “horse-power” includes—
 - (a) where reciprocating steam engines are employed, indicated horse-power;
 - (b) where motor engines are employed, brake horse-power; and
 - (c) where steam turbines are employed, shaft horse-power;
- (4) “long voyage” means a voyage in which the distance between the extreme ports visited by the ship in the course of the voyage is not less than 500 miles; and
- (5) “short voyage” means a voyage in which the distance between the extreme ports visited by the ship in the course of the voyage is less than 500 miles.

[NOTE.—

(1) Section two of the Act includes the following definitions:—

“coasting ship” means a ship employed in plying between ports in the same country, but does not include any fishing, sealing or whaling boat;

“foreign-going ship” means—

- (a) a ship plying between a port in one country and a port in another country; or
- (b) a whaling boat other than a shore-based whaling boat;

“Minister” means the Minister of Transport;

*“proper officer” means the officer designated by the Minister to be the proper officer at the place and in respect of the matter to which reference is made in the provision of this Act in which the expression occurs;

“Secretary” means the Secretary for Transport.

(2) Die aandag word gevestig op onderstaande bepalings van die Handelskeepvaartwet, 1951:—

- (a) Artikel *drie-en-sewentig* bepaal dat sekere gediplomeerde offisiere aan boord van sekere skepe werkzaam moet wees;
- (b) artikel *vier-en-sewentig* bepaal wanneer skeeps-offisiere as behoorlik gediplomeerd beskou word;
- (c) artikel *sewe-en-sewentig* en *agt-en-sewentig* maak voorsiening vir die hou van eksamens vir die toekenning van bekwaamheidsertifikate; en
- (d) artikel *driehonderd vier-en-veftig* maak voorsiening vir die erkenning van bekwaamheidsertifikate of bevoegdheidsertifikate wat in ander lande van die Statebond toegeken word.

Artikel *drie-en-sewentig* van die Wet lees soos volg:—

„(1) Behoudens die bepalings van hierdie artikel, moet die eienaar en die gesagvoerder van elke—

- (a) Suid-Afrikaanse skip wat van enige hawe waar ook al, uitvaar; of
- (b) skip (wat nie 'n Suid-Afrikaanse skip is nie) wat passasiers by 'n Unie-hawe aan boord neem en van 'n Unie-hawe uitvaar,

indien die skip van vyf-en-twintig of meer bruto-registerton is, en tot die kategorie behoort wat in kolom 2 van 'n item in die tabel hieronder aangedui word, en van die tonnemaat of perdekrag is wat in kolom 3 van daardie item aangedui word, sorg dat aan boord van daardie skip in hul toepaslike werkinge die aantal offisiere of ander persone, behoorlik kragtens hierdie Wet gediplomeerd of geag gediplomeerd te wees soos in kolomme 4 en 5 van daardie item aangedui word, werkzaam is:—

(2) Attention is invited to the following provisions of the Merchant Shipping Act, 1951:—

- (a) Section *seventy-three*, which lays down that certain certificated officers are to be employed on certain ships;
- (b) section *seventy-four*, which states when the ships' officers are deemed to be duly certificated;
- (c) sections *seventy-seven* and *seventy-eight*, which make provision for the holding of examinations for the granting of certificates of competency; and
- (d) section *three hundred and fifty-four*, which makes provision for the recognition of certificates of competency or qualification granted in other Commonwealth countries.

Section *seventy-three* of the Act reads as follows:—

“(1) Subject to the provisions of this section, the owner and the master of every—

- (a) South African ship going to sea from any port whatsoever; or
- (b) ship (other than a South African ship) embarking passengers at, and going to sea from, any port in the Union,

shall, if the ship is of twenty-five or more gross register tons, and is of the class shown in column 2 of any item in the table hereunder and of the tonnage or horse-power shown in column 3 of that item, ensure that there are employed on board that ship in their appropriate capacities the number of officers or other persons, duly certificated or deemed to be certificated under this Act, as shown in columns 4 and 5 of that item:—

Kolom 1.	Kolom 2.	Kolom 3.	Kolom 4.	Kolom 5.
Item No.	Kategorie van skip.	Bruto-registertonnemaat of perdekrag.	Aantalle offisiere of ander persone wat in diens moet wees.	Sertifikate waarvan die persone wat in Kolom 4 aangedui word, in besit moet wees, en paragrawe van sub-artikel (1) van artikel <i>vyf-en-sewentig</i> waarby toekenning van sertifikate goedgekeur word.
1	Skip op vreemde vaart.....	Enige.....	Een Een Een	Gesagvoerder: paragraaf (a). Hoof-navigasie-offisier: paragraaf (b). Tweede navigasie-offisier: paragraaf (c).
2	Kusvaarder.....	100 of meer ton.....	Een Een	Gesagvoerder: paragraaf (d). Navigasie-offisier: paragraaf (e).
3	Vissersboot of robbevaarder of walvisvaarder met landbasis	100 of meer ton.....	Een Een Een	Skipper: paragraaf (f). Stuurman: paragraaf (g). Bootsman: paragraaf (h).
4	Kusvaarder of vissersboot, robbevaarder of walvisvaarder met landbasis	50 of meer maar minder as 100 ton	Een Een	Skipper: paragraaf (i). Stuurman: paragraaf (j).
5	Kusvaarder of robbevaarder of walvisvaarder met landbasis	Minder as 50 ton.....	Een Een	Skipper: paragraaf (i). Stuurman: paragraaf (j).
6	Vissersboot.....	Minder as 50 ton.....	Een	Stuurman: paragraaf (j).
7	Skip op vreemde vaart (behalwe 'n walvisvaarder)	1,000 of meer perdekrag..	Een Een	Hoof-ingenieur-offisier: paragraaf (k). Tweede ingenieur-offisier: paragraaf (l).
8	Kusvaarder.....	1,500 of meer perdekrag..	Een	Hoof-ingenieur-offisier: paragraaf (k).
9	Walvisvaarder (behalwe 'n walvisvaarder met landbasis)	1,000 of meer perdekrag..	Een	Hoof-ingenieur-offisier: paragraaf (k).
10	Kusvaarder.....	Minder as 1,500 perdekrag	Een	Tweede ingenieur-offisier: paragraaf (l).
11	Skip op vreemde vaart (behalwe 'n walvisvaarder)	Minder as 1,000 perdekrag	Een	Tweede ingenieur-offisier: paragraaf (l).
12	Walvisvaarder (behalwe 'n walvisvaarder met landbasis)	Minder as 1,000 perdekrag	Een	Tweede ingenieur-offisier: paragraaf (l).
13	Vissersboot of robbevaarder of walvisvaarder met landbasis wat meganiese voortbeweeg word	Meer as 300 perdekrag....	Een Een	See-masjien: paragraaf (m). Assistent-seemasjien: paragraaf (n).
14	Vissersboot of robbevaarder of walvisvaarder met landbasis wat meganiese voortbeweeg word	300 of minder perdekrag...	Een	Assistent-seemasjien: paragraaf (n).

Column 1.	Column 2.	Column 3.	Column 4.	Column 5.
Item No.	Class of Ship.	Gross Register-tonnage or Horse-power.	Numbers of Officers or Other Persons to be employed.	Certificates to be held by Persons shown in Column 4, and paragraphs of sub-section (1) of section seventy-five by which grant of certificates is authorized.
1	Foreign-going ship.....	Any.....	One One One	Master: paragraph (a). Chief Navigating Officer: paragraph (b). Second Navigating Officer: paragraph (c).
2	Coasting ship.....	100 or more tons.....	One One	Master: paragraph (d). Navigating Officer: paragraph (e).
3	Fishing, sealing or shore-based whaling boat	100 or more tons.....	One One One	Skipper: paragraph (f). Mate: paragraph (g). Boatswain: paragraph (h).
4	Coasting ship or fishing, sealing or shore-based whaling boat	50 or more but less than 100 tons	One One	Skipper: paragraph (i). Mate: paragraph (j).
5	Coasting ship or sealing or shore-based whaling boat	Less than 50 tons.....	One One	Skipper: paragraph (i). Mate: paragraph (j).
6	Fishing boat.....	Less than 50 tons.....	One	Mate: paragraph (j).
7	Foreign-going ship, other than a whaling boat	1,000 or more horse-power	One One	Chief Engineer-Officer: paragraph (k). Second Engineer-Officer: paragraph (l).
8	Coasting ship.....	1,500 or more horse-power	One	Chief Engineer-Officer: paragraph (k).
9	Whaling boat, other than a shore-based whaling boat	1,000 or more horse-power	One	Chief Engineer-Officer: paragraph (k).
10	Coasting ship.....	Less than 1,500 horse-power	One	Second Engineer-Officer: paragraph (l).
11	Foreign-going ship, other than a whaling boat	Less than 1,000 horse-power	One	Second Engineer-Officer: paragraph (l).
12	Whaling boat other than a shore-based whaling boat	Less than 1,000 horse-power	One	Second Engineer-Officer: paragraph (l).
13	Power-driven fishing, sealing or shore-based whaling boat	More than 300 horse-power	One One	Marine Engineman: paragraph (m). Assistant Marine Engineman: paragraph (n).
14	Power-driven fishing, sealing or shore-based whaling boat	300 or less horse-power...	One	Assistant Marine Engineman: paragraph (n).

(2) Die Minister kan by kennisgewing in die *Staatskoerant* vereis dat meer of hoër gediplomeerde offisiere of ander persone as wat deur subartikel (1) voorgeskryf word, aan boord van 'n kategorie van skepe van 'n tonnemaat of perdekrag wat in daardie kennisgewing gemeld word, in diens moet wees; en na publikasie van so 'n kennisgewing sorg die eienaar van 'n skip waarvoor dit geld, dat aan boord van daardie skip die aantal offisiere of ander persone wat by daardie kennisgewing voorgeskryf word, behoorlik kragtens hierdie Wet gediplomeerd of geag gediplomeerd te wees, in diens is.

(3) Wanneer die Minister uit 'n verslag deur 'n opnemer daarvan oortuig is dat dit onredelik sou wees om van die eienaar van 'n skip wat voor die inwerkingtreding van hierdie artikel gebou was, te verlang dat hy aan boord van daardie skip die akkommodasie sou moet verskaf wat nodig sou wees om die aantal offisiere of ander persone wat ingevolge subartikel (1) of ingevolge 'n kragtens subartikel (2) uitgereikte kennisgewing in diens moet wees, te akkommodeer, kan hy ten opsigte van daardie skip die vereistes van subartikel (1) of van daardie kennisgewing na goedgeken wysig.

(4) Die eienaar van elke Statebond-skip (behalwe 'n skip wat passasiers by 'n Unie-hawe aan boord neem) wat uit 'n Unie-hawe uitvaar, sorg dat aan boord van die skip in hul toepaslike werkkring saam is 'n gesagvoerder en soveel skeepsoffisiere wat die houters is van sertifikate van sulke grade as wat, volgens die betrokke wette wat in daardie deel van die Statebond waarin die skip geregistreer is, van krag is, die skip verplig is om aan boord te hê wanneer dit uit 'n hawe in daardie deel van die Statebond uitvaar.

(2) The Minister may by notice in the *Gazette* require that more or more highly certificated officers or other persons than are prescribed by sub-section (1) shall be employed on board any class of ships of any tonnage or horse-power specified in that notice; and after the publication of any such notice the owner of any ship to which it applies shall ensure that there are employed on board that ship the number of officers or other persons prescribed by that notice, duly certificated or deemed to be certificated under this Act.

(3) Whenever the Minister is satisfied from a report by a surveyor that it would be unreasonable to require the owner of a ship built before the coming into operation of this section to provide the accommodation on board that ship necessary to accommodate the numbers of officers or other persons required to be employed in terms of sub-section (1), or in terms of a notice issued under sub-section (2), he may vary the requirements of sub-section (1) or of that notice in respect of that ship as he deems fit.

(4) The owner of every Commonwealth ship (other than a ship embarking passengers at a port in the Union) going to sea from any port in the Union shall ensure that there are employed on board that ship in their appropriate capacities a master and so many ships' officers holding certificates of such grades as, by the relative laws in force in that part of the Commonwealth in which the ship is registered, she is required to carry when going to sea from a port in that part of the Commonwealth.

(5) Niemand wat ter voldoening van subartikel (1) of (2) as gesagvoerder of skeepsoffisier in diens geneem is, vaar uit ter see nie tensy hy kragtens hierdie Wet behoorlik gediplomeerd is of geag word aldus gediplomeerd te wees.

(6) By toepassing van subartikel (1) of (2) neem niemand 'n gesagvoerder of skeepsoffisier as sodanig in diens nie sonder vooraf vas te stel dat hy kragtens hierdie Wet behoorlik gediplomeerd is, of geag word aldus gediplomeerd te wees.

(8) Hierdie artikel is nie ten aansien van enige vaartuig wat aan die Spoorwegadministrasie behoort en wat deur daardie Administrasie in verband met sy hawebedryf gebruik word, as daardie vaartuig in geval van nood ter see uitvaar, van toepassing nie."

* Vir die toepassing van hierdie regulasies het die Minister die volgende beamptes as „bevoegde beamptes” aangewys:—

Te Kaapstad en Durban: Die Eerste beampte van die Marine-afdeling;

te Port Elizabeth, Oos-Londen, Mosselbaai, Port Nolloth, Lüderitz en Walvisbaai: Die Koopvaardymeester.]

Sekretaris moet benoembaarheid van kandidate vasstel.

3. (1) As daar twyfel ontstaan omtrent die benoembaarheid van 'n kandidaat tot 'n eksamen, word die saak, ongeag die bepalinge van hierdie regulasies, na die Sekretaris verwys, wie se beslissing dienaangaande finaal is.

(2) As die vraag ontstaan of een of ander sertifikaat nie laer as 'n ander sertifikaat is nie, word dit deur die Sekretaris beslis.

Bewys van nasionaliteit.

4. Geen kandidaat vir 'n bekwaamheidsertifikaat word geëksamineer nie tensy hy bewys lewer dat hy 'n Suid-Afrikaanse burger of 'n burger is van 'n land (behalwe die Unie) wat lid is van die Statebond.

(LET WEL.—Onder gewone omstandighede gaan bewys van nasionaliteit gepaard met die voorlegging van 'n geboortesertifikaat, 'n registrasie- of naturalisasiesertifikaat, of een of ander aanneemlike dokumentêre bewys van nasionaliteit.)

Plekke waar eksamens gehou word.

5. Eksamens word op plekke en tye gehou soos deur die Minister bepaal word.

(LET WEL.—Die Minister het besluit dat eksamens te Kaapstad en Durban gehou moet word. Die tye waarop eksamens gehou sal word, kan op aansoek van die bevoegde beamptes verkry word. Spesiale reëlings kan van tyd tot tyd getref word dat eksamens op ander plekke behalwe Kaapstad en Durban gehou moet word.)

Aansoekvorm.

6. 'n Kandidaat vir 'n bekwaamheidsertifikaat moet die vorm T.V. 5/102, soos in Bylae A uiteengesit, voltooi.

Ander dokumente wat voorgelê moet word.

7. (1) Aansoekvorm T.V. 5/102, behoorlik voltooi, tesame met die kandidaat se—

(a) geboortesertifikaat;

(b) leerlingkapsertifikaat;

(c) ontslagsertifikaat (indien enige); en

(d) getuigskrifte (sien regulasie 10),

moet by die kantoor van die eksaminator ingedien word, of gepos word sodat dit hom by die hawe waar die kandidaat geëksamineer wil word, minstens veertien dae voor die datum waarop hy geëksamineer wil word, bereik, of by die kantoor van die bevoegde beampte by enige ander hawe ingedien word of gepos word, sodat dit hom minstens veertien dae voor die hou van die eksamen bereik: Met dien verstande dat die eksaminator die kandidaat kan toelaat om die eksamen af te lê selfs indien die genoemde dokumente later ingedien of gepos word as wat by daardie regulasie voorgeskryf of verlang word.

(5) No person who has been engaged for the purpose of sub-section (1) or (2) as master or ship's officer shall go to sea as such unless he is duly certificated or deemed to be certificated, in terms of this Act.

(6) No person shall for the purpose of sub-section (1) or (2) employ a master or ship's officer as such without first ascertaining that he is duly certificated, or deemed to be so certificated, in terms of this Act.

(8) This section shall not apply in respect of any vessel belonging to the Railway Administration and used by that Administration in connection with the working of its harbours, if that vessel goes to sea in an emergency."

* For the purposes of these regulations the Minister has designated the following officers as "proper officers":—

At Cape Town and Durban: The Principal Officer of the Marine Division;

at Port Elizabeth, East London, Mossel Bay, Port Nolloth, Lüderitz and Walvis Bay: The Shipping Master.]

Secretary to Determine Eligibility.

3. (1) If any doubt arises as to the eligibility of any candidate to be admitted to any examination, the matter shall, notwithstanding the provisions of these regulations, be referred to the Secretary, whose decision shall be final.

(2) Whenever the question arises whether any certificate is not lower than any other certificate, that question shall be determined by the Secretary.

Proof of Nationality.

4. No candidate shall be examined for a certificate of competency unless he produces proof to the satisfaction of the examiner that he is a South African citizen or a citizen of a country (other than the Union) which is a member of the Commonwealth.

(NOTE.—Proof of citizenship will, in ordinary circumstances, involve the production of a birth certificate, a certificate of registration or of naturalisation, or some other acceptable documentary evidence of nationality.)

Places of Examination.

5. Examinations shall be held at places and on days to be determined by the Minister.

(NOTE.—The Minister has decided that the examinations shall be held at Cape Town and Durban. The days on which examinations will be held may be ascertained on enquiry from the proper officers. Special arrangements may be made from time to time for examinations to be held at places other than Cape Town and Durban.)

Form of Application.

6. A candidate for a certificate of competency shall complete the form T.V. 5/102 set forth in Annex A.

Other Documents to be Submitted.

7. (1) Form T.V. 5/102 properly completed and accompanied by the candidate's—

(a) birth certificate;

(b) certificate of apprenticeship;

(c) discharges (if any); and

(d) testimonials (see regulation 10).

shall be handed in at the office of, or posted so as to reach, the examiner at the port at which the candidate wishes to be examined at least fourteen days before the date on which he wishes to be examined, or handed in at the office of, or posted so as to reach, the proper officer at any other port at least twenty-one days before the date of the examination: Provided that the examiner may allow the candidate to sit even if the said documents were handed in or posted later than is required by this regulation.

(2) As 'n kandidaat in besit is van 'n geldige bekwaamheid- of dienssertifikaat, moet hy, alvorens hy tot die aflê van die eksamen toegelaat word, sodanige sertifikaat by die eksaminator indien.

[LET WEL.—As die kandidaat nie die sertifikaat in (1) (a) hierbo genoem kan voorlê nie, kan 'n ander bevredigende bewys van ouderdom aanvaar word.]

Oorweging van twyfelagtige gevalle.

8. 'n Kandidaat by wie daar twyfel bestaan of hy tot die aflê van 'n eksamen vir 'n bekwaamheidsertifikaat in aanmerking kan kom, kan die dokumente soos in regulasies 6 en 7 uiteengesit en behoorlik voltooi, aan die eksaminator of bevoegde beampte stuur, wat dit dan aan die Sekretaris vir oorweging kan deurstuur.

Aansoeke om inligting.

9. Alle ander navrae aangaande eksamens moet op dieselde wyse soos in regulasie 8 uiteengesit, gedoen word, en word op dieselfde wyse behandel. Kandidaat moet die punt waaroor inligting verlang word, duidelik uiteensit en alle relevante sertifikate en getuigskrifte moet die aansoek om inligting vergesel. Buitelandse aansoeke om inligting kan aan die Sekretaris van Vervoer, Pretoria, geadresseer word.

Getuigskrifte.

10. (1) Behoudens die bepalings van regulasie 14, moet 'n kandidaat vir 'n bekwaamheidsertifikaat getuigskrifte in verband met sy werkswinkeldiens en sy seediens voorlê.

(2) In die getuigskrifte in verband met sy werkswinkeldiens moet daar getuig word van die kandidaat se gedrag en bekwaamheid, en moet die soort werk waarmee hy besig gehou was en die tydperk wat hy by elke vertakking deurgebring het, bv. montering, oprigting, draaiwerk, masjienwerk, ens., vermeld word. Dergelike getuigskrifte moet deur die werkgever of sy verteenwoordiger geteken wees.

(3) In die getuigskrifte in verband met sy kwalifiserende seediens moet daar getuig word van die kandidaat se soberheid, ondervinding, bekwaamheid en algemene goeie gedrag, en sy werklike rang op waghoudiens, die aantal ingenieuroffisiere wat gelyktydig op wag was by die stoomketels en/of die hoofaandryfmasjinerie en die aard van die dienste wat hy verrig het, moet daarin vermeld word. Dergelike getuigskrifte moet geteken wees deur die hoof-ingenieuroffisier onder wie die seediens verrig was en, indien moontlik, moet hulle ook geëndosseer wees deur die ingenieur-superintendent of, as daar nie so 'n superintendent is nie, deur die gesagvoerder of verteenwoordiger van die eienaar. As die kandidaat 'n hoof-ingenieuroffisier is, moet die getuigskrifte geteken word deur die ingenieur-superintendent of die besturende eienaar of die sekretaris van die redery.

[LET WEL.—

(1) As die kandidaat ietwat hardhorig is of aan 'n ander liggaamsgebrek ly, wat van so 'n aard is dat dit hom by die behoorlike uitvoering van sy pligte as ingenieuroffisier op waghoudiens sou kan belemmer, moet daar in sy getuigskrifte vermeld word of die gebrek hom werklik enigsins by die behoorlike uitvoering van sy pligte belemmer het.

(2) Behalwe in gevalle waar die kandidaat 'n hoof-ingenieuroffisier is, sal daar in die reël nie beskou word dat getuigskrifte wat slegs deur die superintendent van die redery of ander beamptes geteken word, voldoende is nie.

(3) Dit is wenslik dat die kandidaat se totale seediens gedek moet word deur getuigskrifte waarin daar getuig word van sy soberheid, ondervinding, bekwaamheid en algemene goeie gedrag.

(4) Voorbeelde van die getuigskrifvorms wat aanbeveel word, word in Bylae B uiteengesit.]

Doofheid en ander liggaams- of geestesgebreke.

11. (1) As die eksaminator gedurende die loop van 'n eksamen vind dat 'n kandidaat doof is, of 'n spraakgebrek het, of aan een of ander liggaams of geestesgebrek ly, en oortuig is dat die mate van doofheid of gebrek of swakte sodanig is dat dit die kandidaat onbekwaam sou maak

(2) If a candidate is in possession of a valid certificate of competency or service, he shall, before being admitted to the examination for which he wishes to sit, hand in such certificate to the examiner.

[NOTE.—If the candidate is not able to produce the certificate mentioned under (1) (a), other satisfactory proof of age may be accepted.]

Consideration of Doubtful Cases.

8. A candidate who has any doubt whether he is eligible to be examined for a certificate of competency may forward the documents enumerated in regulations 6 and 7, duly completed, to the examiner or proper officer, who may refer them to the Secretary for consideration.

Enquiries.

9. All other enquiries regarding examinations shall be made and dealt with in the same way as detailed in regulation 8. Candidates shall clearly state the point on which information is sought and all relevant certificates and testimonials shall accompany the enquiry. Enquiries from abroad may be addressed to the Secretary for Transport, Pretoria.

Testimonials.

10. (1) Subject to the provisions of regulation 14, a candidate for a certificate of competency shall produce testimonials covering his workshop service and his sea service.

(2) The testimonials covering his workshop service shall testify to the candidate's conduct and ability, and state the kind of work on which he was engaged and the period of time spent in each branch, e.g. fitting, erecting, turning, machine work, etc. These testimonials shall be signed by the employer or his representative.

(3) The testimonials covering his qualifying sea service shall testify to the candidate's sobriety, experience, ability and general good conduct and state his actual rank on watch, the number of Engineer-Officers simultaneously on watch on the boilers and/or the main propelling machinery and the nature of the duties performed by him. These testimonials shall be signed by the Chief Engineer-Officer under whom the service has been performed and, if possible, they shall also be endorsed by the Engineer Superintendent or where there is no such Superintendent by the Master or representative of the owner. Where the candidate is a Chief Engineer-Officer, the testimonials shall be signed by the Engineer Superintendent or managing owner or the secretary of the company.

[NOTE.—

(1) If a candidate is somewhat hard of hearing or suffers from any other physical defect of such a nature that it might interfere with the proper performance of his duties as an Engineer-Officer on watch, it should be stated in his testimonials whether the defect did in fact interfere in any way with the proper performance of the candidate's duties.

(2) Except in cases where the candidate is a Chief Engineer-Officer, testimonials signed only by the company's Superintendent or other officials will not, as a rule, be regarded as sufficient.

(3) It is desirable that the whole of the candidate's sea service should be covered by testimonials certifying to his sobriety, experience, ability and general good conduct.

(4) Specimen copies of the form of testimonials recommended are shown in Annex B.]

Deafness and Other Physical and Mental Disabilities.

11. (1) If during the progress of an examination the examiner finds that a candidate is deaf, or has an impediment in his speech, or suffers from some other physical or mental infirmity, and is satisfied that the degree of deafness or the impediment or other infirmity is such as to

om die gewone pligte van die rang waartoe die sertifikaat waarvoor hy geëksamineer word hom die reg sou verleen om te hou, in 'n skip te verrig, moet hy nie toelaat dat die kandidaat die eksamen voltooi nie.

(2) Die eksaminator moet aan die Sekretaris verslag doen van alle gevalle waar sodanig opgetree is.

(3) 'n Kandidaat teen wie, ingevolge paragraaf (1) opgetree is, kan na die Sekretaris appelleer om die omstandighede van sy geval in hersiening te neem.

(4) Die Sekretaris kan by beoordeling of so 'n kandidaat weer tot die afle van 'n eksamen toegelaat mag word, enige doktersertifikaat wat daarna voorgelê word en waarin verklaar word dat die gehoor, spraak of liggaams- of geestestoestand van die kandidaat verbeter het, of normaal is, in oorweging neem.

(LET WEL.—Die aandag word gevestig op die bepalinge van artikel *sewe-en-tagtig* van die Wet wat die bevoegde beampte magtig om, as dit te eniger tyd vir hom voorkom dat die houer van 'n bekwaamheid- of dienssertifikaat weens slegte gesondheid of geestes- of liggaamsgebrek ongeskik is om die pligte wat van hom geverg word, te verrig, te beveel dat hy hom aan ondersoek deur 'n geneesheer moet onderwerp. As die Minister na oorweging van die verslag oor die mediese ondersoek oortuig is dat die betrokke persoon onbekwaam is om die pligte waarop sy bekwaamheid- of dienssertifikaat betrekking het op bevredigende wyse te verrig, kan hy opdrag gee dat die houer nie in die hoedanigheid waarvan in die sertifikaat melding gemaak word of in enige ander deur die Minister bepaalde hoedanigheid in diens geneem word of ter see uitvaar nie.)

Onvoldoende diens.

12. (1) As daar bevind word dat 'n kandidaat nadat hy in die eksamen geslaag het, onvoldoende diens het vir die toekenning aan hom van 'n sertifikaat van die graad waarin hy geslaag het, word die sertifikaat waarop hy geregtig is, behoudens die bepalinge van hierdie regulasie, nie aan hom toegeken nie.

(2) As die Sekretaris nie oortuig is dat die fout in die berekening van die kandidaat se diens weens die skuld of opsetlike wanvoorstelling van die kandidaat ontstaan het nie, word die sertifikaat agterweë gehou hangende die voorlegging van bevredigende bewys dat die vereiste diens volledig voltooi is, waarop die sertifikaat, behoudens die bepalinge van hierdie regulasies, aan hom uitgereik word.

(3) As die Sekretaris oortuig is dat die fout opsetlik gedoen is, word die sertifikaat agterweë gehou totdat die kandidaat die vereiste kwalifiserende diens volledig voltooi het en sodanige verdere diens voltooi het as wat die Sekretaris mag bepaal, en die toepaslike gelde weer betaal het en opnuut in die eksamen geslaag het.

(4) Addisionele diens wat deur 'n kandidaat ingevolge paragraaf (3) verrig word, kom nie as kwalifiserende diens vir enige ander sertifikaat in aanmerking nie.

[LET WEL.—Die aandag word gevestig op subartikel (2) van artikel *agt-en-sewentig* van die Wet, wat bepaal dat die Minister te eniger tyd voor die aflewering van 'n sertifikaat kan gelas dat die applikant opnuut geëksamineer word deur die eksaminatore wat die eksamen afgeneem het of deur enige ander eksaminatore, en dat nadere ondersoek na sy getuigskrifte of inbors of albei ingestel word, en as hy nie met die uitslag tevrede is nie, kan gelas dat geen sertifikaat aan hom uitgereik word nie.]

Afskrifte van verlore sertifikate.

13. 'n Applikant vir 'n verlore sertifikaat, ditsy van bekwaamheid of diens, moet die voorgeskrewe aansoekvorm T.V. 5/103 soos in Bylae A uiteengesit, voltooi, met vermelding van alle besonderhede, en moet dit aan die bevoegde beampte oorhandig en terselfdertyd 5s. betaal. 'n Verklaring aangaande die omstandighede waaronder die sertifikaat verlore geraak het, moet gedoen word voor die bevoegde beampte, wat die aansoekvorm aan die Sekretaris moet deurstuur.

As die applikant kan aantoon dat die sertifikaat weens skipbreuk of brand aan boord verlore geraak het, is geen gelde betaalbaar nie.

render the candidate incompetent to discharge the ordinary duties of the station on a ship which the certificate for which the candidate is being examined would entitle him to hold, he shall not allow the candidate to complete the examination.

(2) The examiner shall report to the Secretary all cases in which action of this nature is taken.

(3) A candidate against whom action has been taken in terms of paragraph (1) may appeal to the Secretary for a review of the circumstances of his case.

(4) The Secretary may, in deciding whether such a candidate may be allowed to sit again for an examination, take into consideration any medical certificate subsequently produced stating that the candidate's hearing, speech or physical or mental condition has improved or is normal.

(NOTE.—Attention is invited to the provisions of section *eighty-seven* of the Act which empowers the proper officer to require the holder of a certificate of competency or service to submit himself to a medical examination, if at any time it appears that owing to ill-health or mental or physical defect he is unfit to perform the duties required of him. If after consideration of the medical report the Minister is satisfied that the person concerned is incapable of performing satisfactorily the duties appertaining to his certificate of competency or service he may direct that the holder shall not be engaged or go to sea in the capacity referred to in the certificate or in any other capacity specified by the Minister.)

Service found to be Insufficient.

12. (1) If after a candidate has passed the examination it is discovered that his service is insufficient to entitle him to receive a certificate of the grade for which he has passed, the certificate shall not, subject to the provisions of this regulation, be granted to him.

(2) If the Secretary is not satisfied that the error in the calculation of the candidate's service occurred through the fault of or through wilful misrepresentation by the candidate, the certificate shall be withheld pending the production of satisfactory proof that the necessary service has been completed in full, upon which the certificate shall, subject to the provisions of these regulations, be issued to him.

(3) If the Secretary is satisfied that the error was deliberately made, the certificate shall be withheld until the candidate has completed the necessary qualifying service in full and has performed such further period of service as may be decided by the Secretary, has again paid the appropriate fee and has again passed the examination.

(4) Any additional service performed by a candidate in terms of paragraph (3) shall not count as qualifying service for any other certificate.

[NOTE.—Attention is invited to sub-section (2) of section *seventy-eight* of the Act, which provides that the Minister may, at any time before the delivery of a certificate, require a re-examination of the applicant by the examiners who made the examination or by other examiners, and order a further enquiry into his testimonials or character or both, and if not satisfied with the result may order that the certificate be not granted to him.]

Copies of Lost Certificates.

13. An applicant for a certified copy of a lost certificate, whether of competency or service, shall complete the prescribed form of application T.V. 5/103 set forth in Annex A, giving the necessary particulars, and shall hand it to the proper officer, paying at the same time the fee of 5s. A declaration as to the circumstances in which the certificate was lost shall be made by the applicant before the proper officer, who shall transmit the form of application to the Secretary.

No fee is chargeable if the applicant shows that the certificate was lost through shipwreck or fire on board ship.

Wangedrag van kandidate.

14. (1) In die geval van 'n kandidaat wat—
- (a) na ondertekening van die ooreenkoms met die bemanning versuim het om by sy skip aan te sluit; of
 - (b) van sy skip gedros het nadat hy aangesluit het; of
 - (c) deur 'n wetlike geregshof skuldig bevind is aan 'n misdryf waarvoor hy tot gevangenisstraf sonder die keuse van 'n boete veroordeel is, of wat na die mening van die eksaminator 'n ernstige misdryf is; of
 - (d) skuldig bevind is aan 'n misdryf ten opsigte waarvan 'n inskrywing in die amptelike skeepsjoernaal gemaak is kragtens paragraaf (b) van artikel honderd drie-en-tagtig van die Wet en wat na die mening van die eksaminator 'n ernstige misdryf is,
- dek die getuigskrifte wat ingevolge regulasie 10 (3) vereis word die tydperk van twee jaar volgende op sodanige wangedrag: Met dien verstande dat op aansoek van die kandidaat die Sekretaris, nadat hy die saak ondersoek het, die tydperk na goeë dunke kan verminder.

(2) As daar te eniger tyd aan die Sekretaris gerapporteer word dat 'n kandidaat aan 'n eksaminator of enige ander persoon wat ingevolge hierdie Wet in diens is, geld of iets anders aangebied het met die doel om hom enigerwyse in verband met die eksaminering te beïnvloed, doen die Sekretaris ondersoek en as hy oortuig is dat die kandidaat met dié doel so 'n aanbod gemaak het, kan hy weier dat die kandidaat geëksamineer word, of as daar reeds met die eksamen 'n aanvang gemaak is, kan hy die eksaminator gelas om die eksaminering te staak, of as dit reeds voltooi is, kan hy die uitslag daarvan kanselleer en gelas dat die gelde wat deur die kandidaat betaal is, verbeurd verklaar word, en weier dat hy weer in die Unie gedurende 'n tydperk van hoogstens twaalf maande, gereken vanaf die datum van sodanige aanbod, tot die afle van 'n eksamen toegelaat mag word.

HOOFTUK II.**A. KWALIFIKASIES WAT VEREIS WORD VAN 'N KANDIDAAT VIR 'N BEKWAAMHEIDCERTIFIKAAT AS TWEDE INGENIEUROFFISIER EN ENDOSSEMENT.***Ouderdom en ander kwalifikasies.*

15. (1) 'n Kandidaat vir 'n bekwaamheidscertificaat as tweede ingenieuroffisier moet minstens een-en-twintig jaar oud wees en moet bewys lewer dat hy—

- (a) voldoen het aan die een of ander van die vereistes met betrekking tot werkswinkeldiens of ander opleiding uiteengesit in regulasies 16, 17 en 18, behoudens die bepalings betreffende vergoedende seediens in regulasie 19 uiteengesit, en
 - (b) die seediens verrig het wat ooreenkomstig regulasie 20 vereis word,
- en moet slaag in die by regulasie 37 voorgeskrewe eksamen.

(2) 'n Kandidaat vir die endossement van 'n bekwaamheidscertificaat as tweede ingenieuroffisier moet bewys lewer dat hy die bykomstige seediens verrig het wat ooreenkomstig regulasie 21 vereis word, en moet in die by regulasie 37 voorgeskrewe eksamen slaag.

A. (1) WERKSWINKELDIENS.*Diens as leerling-ingenieur of -vakman.*

16. (1) 'n Kandidaat vir 'n bekwaamheidscertificaat as tweede ingenieuroffisier moet bewys kan lewer dat hy, sedert hy die ouderdom van vyftien jaar bereik het, vir minstens vier jaar as leerling-ingenieur of -vakman op bevredigende wyse diens gedoen het aan werk wat geskik is vir die opleiding van 'n seemasjinis in die vervaardiging of instandhouding van masjinerie.

Misconduct by Candidates.

14. (1) In the case of a candidate who—

- (a) after having signed the agreement with the crew has neglected to join his ship; or
- (b) after having joined has deserted his ship; or
- (c) has been convicted by a legal tribunal of an offence for which he has been sentenced to imprisonment without the option of a fine or which the examiner considers to be of a serious nature; or
- (d) has been found guilty of an offence in respect of which an entry has been made in the official log-book in terms of paragraph (b) of section one hundred and eighty-three of the Act and which the examiner considers to be of a serious nature,

the testimonials required in terms of regulation 10 (3) shall cover the period of two years subsequent to such misconduct: Provided that upon the application of the candidate the Secretary, after having investigated the matter, may in his discretion reduce the period.

(2) If at any time it is reported to the Secretary that a candidate has offered any sum of money or other thing whatsoever to any examiner or any other person employed under the Act for the purpose of influencing him in any manner in relation to an examination, the Secretary shall enquire into the matter, and if he is satisfied that the candidate has made such an offer for the said purpose, he may refuse to permit the candidate to be examined or, if the examination has already commenced, may direct the examiner not to proceed with the examination, or, if the examination has already been completed, may cancel the result thereof, and may order the forfeiture of any fee paid by the candidate, and may refuse to allow him to present himself at any future examination in the Union for a period not exceeding twelve months from the date of the making or such offer.

CHAPTER II.**A. QUALIFICATIONS REQUIRED OF CANDIDATES FOR CERTIFICATES OF COMPETENCY AS SECOND ENGINEER-OFFICER AND ENDORSEMENT.***Age and Other Qualifications.*

15. (1) A candidate for a certificate of competency as Second Engineer-Officer shall be not less than twenty-one years of age and shall produce proof—

- (a) of having complied with one or other of the requirements as regards workshop service or other training set out in regulation 16, 17 and 18, subject to the provisions as to compensatory sea service set out in regulation 19, and
- (b) of having performed the sea service required in terms of regulation 20,

and shall pass the examination prescribed in regulation 37.

(2) A candidate for the endorsement of a certificate of competency as Second Engineer-Officer shall produce proof of having performed the additional sea service required in terms of regulation 21, and shall pass the examination prescribed in regulation 37.

A. (1) WORKSHOP SERVICE.*Service as Apprentice Engineer or Journeyman.*

16. (1) A candidate for a certificate of competency as Second Engineer-Officer is required to prove that since reaching the age of 15 he has served satisfactorily for not less than four years as apprentice engineer or journeyman on work suitable for the training of a marine engineer in the manufacture or maintenance of machinery.

(2) Minstens een van die vier jaar se werkswinkeldiens wat ooreenkomstig paragraaf (1) van hierdie regulasie vereis word, moet bestee gewees het aan die monteer, oprigting of die reparasie van masjinerie van 'n geskikte grootte of beskrywing (bv. werk aan marine-masjiene en soliede hulpmasjiene van 'n soort wat in skepe geïnstalleer word, of aan binnebrandaandryfmasjinerie wat 'n soortgelyke waarde het by die opleiding van seemasjiniste) in of buite die werkswinkel.

(3) Die oorblywende drie jaar kon bestee gewees het aan werk van die aard in paragraaf (2) van hierdie regulasie voorgeskryf of aan ander geskikte werk, onderworpe aan 'n tydtoekenning vir elke soort werk op die volgende basis:—

Metaaldraai.....	Voltyds tot 'n maksimum van twee jaar.
Koper-afwerking.....	Voltyds tot 'n maksimum van een jaar.
Ketelgieterij of die herstel van ketels	Voltyds tot 'n maksimum van een jaar.
Modelmakery.....	Voltyds tot 'n maksimum van een jaar.
Skaafwerk, gleufwerk, sterk-arm skaafwerk en freeswerk	Voltyds tot 'n maksimum van een jaar.
Werk in gereedskapkamer....	Voltyds tot 'n maksimum van een jaar.
Goedgekeurde skemas van opleiding in die gebruik van hand- en kleinmasjiengereedskap	Voltyds tot 'n maksimum van een jaar.
Smedery.....	Voltyds tot 'n maksimum van ses maande.
Koperslaanwerk.....	Voltyds tot 'n maksimum van ses maande.
Sweiswerk.....	Voltyds tot 'n maksimum van ses maande.
Werk in 'n tekenaarskantoor as tekenaar of ingenieur volgens ooreenkoms in diens geneem, detailtekening of ontwerp	Voltyds tot 'n maksimum van een jaar. As meer as een jaar in die tekenaarskantoor uitgedien is, word slegs die helfte van die bykomstige tyd bygereken.
Elektriese winkel- of herstelwerk nie reeds hierbo gedek nie (uitgesonderd werk van minderwaardige aard)	Voltyds tot een jaar; slegs die helfte van bykomstige dienstdyd word bygereken. Die maksimumtotaal is agtien maande.

Studente- of tegniese leerlingsskappe.

17. As alternatief vir die vereistes van regulasie 16, kan die Sekretaris na eie goeddunke 'n kandidaat toelaat wat vir minstens vier jaar op bevredigende wyse diens gedoen het in 'n georganiseerde studente- of tegniese leerlingsskap wat deur die Sekretaris goedgekeur word: Met dien verstande dat die kandidaat 'n toepaslike tegniese kwalifikasie behaal het en minstens een jaar bestee het aan die monteer, oprigting of reparasie van die soort masjinerie waarvan in paragraaf (2) van regulasie 16 melding gemaak word.

(LET WEL.—Die Sekretaris sal, wanneer aansoek gedoen word, advies gee oor die aanvaarbaarheid van enige sodanige leerlingsskappe vir die toepassing van hierdie regulasie.)

Voltydse kursusse aan tegniese skole, tegniese kolleges of universiteite.

18. (1) As verdere alternatief vir die vereistes van regulasie 16, kan die Sekretaris na eie goeddunke 'n kandidaat toelaat wat vir minstens drie jaar 'n goedgekeurde voltydse studiekursus in masjienbou aan 'n goedgekeurde tegniese skool, tegniese kollege of universiteit op bevredigende wyse voltooi het en vir minstens vier-en-twintig maande in werksinkels diens verrig het aan geskikte werk vir die opleiding van seemasjiniste: Met dien verstande dat minstens ses van die vier-en-twintig maande wat by hierdie regulasie vereis word, agtereenvolgens bestee was aan die monteer, oprigting of reparasie van die soort masjinerie waarvan in paragraaf (2) van regulasie 16 melding gemaak word.

(2) Geskikte werkswinkelopleiding wat ontvang is gedurende die vakansietydperke van die tegniese skool, tegniese kollege of universiteit; en tydperke van altesaam hoogstens ses maande wat bestee was aan die werksinkels se leerling-opleidingskemas vir monteurs en metaaldraaiers of aan soortgelyke opleiding in die werksinkels van 'n tegniese skool, tegniese kollege of universiteit.

(2) Not less than one of the four years' workshop service required in terms of paragraph (1) of this regulation shall have been devoted to fitting, erecting or repairing machinery of a suitable size or description (e.g. work on marine engines and substantial auxiliary machinery of a type fitted in ships, or on motive power machinery which has a similar value in the training of marine engineers) either in the works or outside.

(3) The remaining three years may have been spent on work of the nature prescribed in paragraph (2) of this regulation or on other suitable work, subject to a time allowance for each type of work on the following basis:—

Metal turning.....	Full time up to a maximum of two years.
Brass finishing.....	Full time up to a maximum of one year.
Boiler making or repairing of boilers	Full time up to a maximum of one year.
Pattern making.....	Full time up to a maximum of one year.
Planing, slotting, shaping and milling	Full time up to a maximum of one year.
Tool room.....	Full time up to a maximum of one year.
Approved schemes of training in the use of hand and small machine tools	Full time up to a maximum of one year.
Smith work.....	Full time up to a maximum of six months.
Coppersmith work.....	Full time up to a maximum of six months.
Welding.....	Full time up to a maximum of six months.
Work in drawing office as draughtsman or engineer engaged on arrangement, detail or design	Full time up to one year. When more than one year has been spent in the drawing office only half the additional time will count.
Electrical shop or repair work not already covered above (excluding work of a minor nature)	Full time up to one year; additional at half rate. Maximum total 18 months.

Student or Technical Apprenticeships.

17. As an alternative to the requirements of regulation 16 the Secretary may in his discretion admit a candidate who has performed satisfactory service for not less than four years in an organised student or technical apprenticeship approved by the Secretary: Provided that the candidate has obtained an appropriate technical qualification and has devoted not less than one year to the fitting, erecting or repairing the type of machinery referred to in paragraph (2) of regulation 16.

(NOTE.—The Secretary will, upon application, advise on the acceptability of any such apprenticeships for the purpose of this regulation.)

Full-time Technical Schools, College or University Courses.

18. (1) As a further alternative to the requirements of regulation 16 the Secretary may in his discretion admit a candidate who has satisfactorily completed at an approved technical school, college or university an approved full-time course of study of at least three years in mechanical engineering, and has served for not less than twenty-four months in workshops on suitable work for the training of a marine engineer: Provided that of the twenty-four months required by this regulation at least six consecutive months shall have been devoted to the fitting, erecting or repairing the type of machinery referred to in paragraph (2) of regulation 16.

(2) Suitable workshop training carried out during technical school, college or university vacations and periods totalling not more than six months spent in works apprentice training schemes for fitters and turners or on similar training in technical school, college or university.

teit word bygereken vir die diens van vier-en-twintig maande wat by hierdie regulasie vereis word tot 'n totale maksimum van nege maande. Die duur van die afsonderlike tydperke van opleiding moet minstens een maand wees.

(LET WEL.—Die Sekretaris sal, wanneer aansoek gedoen word, advies gee oor die aanvaarbaarheid van enige kursusse wat aan 'n tegniese skool, tegniese kollege of universiteit in enige Statebondslan voltooi is.)

Vergoedende diens.

19. (1) As 'n kandidaat vir die by regulasies 16, of 17, of 18 voorgeskrewe tydperk werkswinkeldiens verrig het, kan vir die tekorte in enige van die soorte diens vergoed word deur verdere werkswinkeldiens van 'n geskikte aard te verrig of deur vergoedende diens op gereelde waghoudiens of met dagwerk ter see.

(2) Vergoedende seediens moet verrig word of—

(a) met dagwerk as ingenieuroffisier aan boord van skepe van minstens 375 perdekrags wat seereise tussen een hawe en 'n ander hawe onderneem of in vissersbote of seevarende sleepbote van minstens 375 perdekrags; of

(b) op gereelde waghoudiens op dergelike skepe.

Twee-derdes van die tyd wat aldus bestee word in skepe wat lang-seereise onderneem, vier-negendes van die tyd wat aldus bestee word in skepe wat kort-seereise onderneem, en een-derde van die tyd wat aldus bestee word in vissersbote of in seevarende sleepbote word bygereken vir die tydperk van kwalifiserende werkswinkeldiens: Met dien verstande dat geen sodanige werk wat verrig word voordat die kandidaat die ouderdom van twintig jaar bereik het, bygereken word nie.

B. (1) SEEDIENS.

Seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

20. 'n Kandidaat vir 'n bekwaamheidsertifikaat (stoom of motor) as tweede ingenieuroffisier moet, na voltooiing van die werkswinkeldiens wat ooreenkomstig regulasies 16, 17 of 18 vereis word, en die seediens (indien enige) wat ingevolge regulasie 19 in die plek daarvan aanvaar word, bewys lewer dat hy vir die volgende tydperk seediens verrig het:—

(i) As 'n bekwaamheidsertifikaat (stoom) vereis word, een-en-twintig maande, waarvan minstens nege maande bestee moes gewees het by die ketels en hoofaandryfmasjinerie van 'n stoomskip. Hierdie tydperk van minstens nege maande moet diens van minstens ses maande by die ketels en diens van minstens ses maande by die hoofaandryfmasjinerie insluit: Met dien verstande dat die diens by die ketels en die diens by die hoofaandryfmasjinerie gelyktydig verrig kon gewees het. Die oorblywende twaalf maande (of die balans van twaalf maande) kon deurgebring gewees het by die ketels van 'n stoomskip of by die hoofaandryfmasjinerie van 'n stoomskip of motorskip, of by geskikte hulpmasjiene van 'n stoom- of motorskip (vergelyk regulasie 32), of met dagwerk (vergelyk regulasie 22);

(ii) as 'n bekwaamheidsertifikaat (motor) vereis word, een-en-twintig maande, waarvan minstens ses maande bestee moes gewees het by die hoofaandryfmasjinerie van 'n motorskip. Die oorblywende vyftien maande (of balans van vyftien maande) kon deurgebring gewees het by die hoofaandryfmasjinerie van 'n stoomskip of motorskip, of by geskikte hulpmasjiene van 'n stoomskip of motorskip (vergelyk regulasie 32) of in 'n mate van hoogstens ses maande by die ketels van 'n stoomskip, of met dagwerk (vergelyk regulasie 22);

university workshops shall count towards the twenty-four months' service required by this regulation up to an overall maximum of nine months. Separate periods of training shall be of not less than one month's duration.

(NOTE.—The Secretary will, upon application, advise on the acceptability of any technical school, college or university courses completed in any Commonwealth country.)

Compensatory Service.

19. (1) Where a candidate performs workshop service for the period of time prescribed in regulations 16, or 17, or 18, deficiencies in any of the types of service may be made up by further workshop service of a suitable character or by compensatory service on regular watch or on day work at sea.

(2) Compensatory sea service shall be performed either—

(a) on day work as Engineer-Officer on board ships of not less than 375 horsepower making voyages from one port to another or in fishing boats or sea-going tugs of not less than 375 horsepower; or

(b) on regular watch on such ships.

Two-thirds of the time so spent in ships making long voyages, four-ninths of the time so spent in ships making short voyages and one-third of the time so spent in fishing boats or in sea-going tugs shall be counted towards the period of qualifying workshop service: Provided that no such work performed before the age of 20 shall be so counted.

B. (1) SEA SERVICE.

Sea Service required of a Candidate for a Certificate of Competency as Second Engineer-Officer.

20. A candidate for a certificate of competency (steam or motor) as Second Engineer-Officer shall, after completing the workshop service required in terms of regulations 16, 17 or 18 and the sea service (if any) accepted in lieu thereof under regulation 19, produce proof of having performed the following period of sea service:—

(i) If a certificate of competency (steam) is required, twenty-one months, of which at least nine months shall have been spent on the boilers and main propelling machinery of a steamship. This period of at least nine months' shall include at least six months' service on the boilers and six months' service on the main propelling machinery: Provided that the service on the boilers and the service on the main propelling machinery may have been simultaneous. The remaining twelve months (or balance of twelve months) may have been spent on the boilers of a steamship or on the main propelling machinery of a steam or motor ship, or on suitable auxiliaries of a steam or motor ship (see regulation 32), or on day work (see regulation 22);

(ii) if a certificate of competency (motor) is required, twenty-one months, of which at least six months shall have been spent on the main propelling machinery of a motor ship. The remaining fifteen months (or balance of fifteen months) may have been spent on the main propelling machinery of a steam or motor ship, or on suitable auxiliaries of a steam or motor ship (see regulation 32), or to the extent of not more than six months on the boilers of a steamship, or on day work (see regulation 22);

(iii) as 'n gekombineerde bekwaamheidsertifikaat (stoom en motor) vereis word, vier-en-twintig maande, waarvan minstens—

- (1) nege maande bestee moes gewees het by die ketels en hoofaandryfmasjinerie van 'n stoomskip. Hierdie tydperk van minstens nege maande moet diens van minstens ses maande by die ketels en diens van minstens ses maande by die hoofaandryfmasjinerie insluit: Met dien verstande dat die diens by die ketels en die diens by die hoofaandryfmasjinerie gelyktydig verrig kon gewees het, en
- (2) ses maande uitgedien moes gewees het by die hoofaandryfmasjinerie van 'n motorskip. Die oorblywende nege maande (of balans van nege maande) kon uitgedien gewees het by die ketels van 'n stoomskip of by die hoofaandryfmasjinerie van 'n stoomskip of motorskip of by geskikte hulpmasjiene van 'n stoomskip of motorskip (vergelyk regulasie 32), of met dagwerk (vergelyk regulasie 22).

Seediens wat vereis word vir die endossement van 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

21. 'n Kandidaat vir die endossement van 'n bekwaamheidsertifikaat (stoom, of motor) as tweede ingenieuroffisier moet bewys lewer dat hy vir die volgende tydperk seediens verrig het:—

- (i) As die motorendossement van 'n bekwaamheidsertifikaat (stoom) vereis word, drie maande benewens die seediens wat ooreenkomstig klousule (i) van regulasie 20 vereis word: Met dien verstande dat hy altesaam vir 'n tydperk van minstens ses maande diens verrig het by die hoofaandryfmasjinerie van 'n motorskip;
- (ii) as die stoomendossement van 'n bekwaamheidsertifikaat (motor) vereis word, ses maande benewens die seediens wat ooreenkomstig klousule (ii) van regulasie 20 vereis word: Met dien verstande dat hy altesaam vir 'n tydperk van minstens nege maande diens verrig het by die ketels en hoofaandryfmasjinerie van 'n stoomskip. Hierdie tydperk van minstens nege maande moet diens van minstens ses maande by die ketels en diens van minstens ses maande by die hoofaandryfmasjinerie insluit: Met dien verstande dat die diens by die ketels en die diens by die hoofaandryfmasjinerie kon gelyktydig verrig gewees het.

Soort seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

22. Die seediens wat ooreenkomstig regulasies 20 en 21 vereis word, moes verrig gewees het in skepe van minstens 375 perdekrag wat lang-seereise onderneem, as ingenieuroffisier ter see op gereelde waghoudiens van altesaam minstens agt uur uit elke diens van vier-en-twintig uur waarop daar aanspraak gemaak word, behalwe dat dagwerk, waarby bedoel word ingenieurswerk ter see uitgesonderd werk wat verrig is op gereelde waghoudiens as die helfte tel behoudens 'n maksimum-toekenning van ses maande vir die kwalifiserende tydperk van seediens. Met dien verstande dat die werk verrig was in die masjien- of ketelruim van 'n stoomskip of motorskip ter see.

(LET WEL.—Die aandag word gevestig op regulasie 31 waarin die voorwaardes uiteengesit word waarop daar toegelaat kan word dat diens wat verrig word in skepe, uitgesonderd skepe wat lang-seereise onderneem, as seediens bereken word.)

Kwytstelling van seediens vir tweede ingenieuroffisier.

23. 'n Kandidaat vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier wat, voor die aanvang van sy kwalifiserende seediens, geslaag het in deel A van die eksamen vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier of wat 'n sertifikaat, diploma of graad

(iii) if a combined certificate of competency (steam and motor) is required, twenty-four months, of which at least—

- (1) nine months shall have been spent on the boilers and main propelling machinery of a steamship. This period of at least nine months shall include at least six months' service on the boilers and six months' service on the main propelling machinery: Provided that the service on the boilers and the service on the main propelling machinery may have been simultaneous; and
- (2) six months shall have been spent on the main propelling machinery of a motor ship. The remaining nine months (or balance of nine months) may have been spent on the boilers of a steamship or on the main propelling machinery of a steam or motor ship or on suitable auxiliaries of a steam or motor ship (see regulation 32), or on day work (see regulation 22).

Sea Service required for Endorsement of a Certificate of Competency as Second Engineer-Officer.

21. A candidate for the endorsement of a certificate of competency (steam or motor) as second Engineer-Officer shall produce proof of having performed the following period of sea service:—

- (i) If the motor endorsement of a certificate of competency (steam) is required, three months in addition to the sea service required in terms of clause (i) of regulation 20: Provided that not less than six months' service in all shall have been served on the main propelling machinery of a motor ship;
- (ii) if the steam endorsement of a certificate of competency (motor) is required, six months in addition to the sea service required in terms of clause (ii) of regulation 20: Provided that not less than nine months' service in all shall have been served on the boilers and main propelling machinery of a steamship. This period of at least nine months shall include at least six months' service on the boilers and six months' service on the main propelling machinery: Provided that the service on the boilers and on the main propelling machinery may have been simultaneous.

Type of Sea Service required of a Candidate for a Certificate of Competency as Second Engineer-Officer.

22. The sea service required in terms of regulations 20 and 21 shall have been performed in ships of not less than 375 horsepower making long voyages, as an Engineer-Officer at sea on regular watch totalling at least eight hours out of every twenty-four hours' service claimed, except that day work, by which is meant engineering work at sea other than that performed on regular watch, shall be counted at half rate subject to a maximum allowance of six months towards the qualifying period of sea service: Provided that the work has been carried out within the engine or boiler spaces of a steam or motor ship at sea.

(NOTE.—Attention is invited to regulation 31 in which are set out the conditions under which service performed in ships other than ships making long voyages, may be allowed to count.)

Remission of Sea Service for Second Engineer-Officers.

23. Candidates for certificates of competency as Second Engineer-Officer who, before commencing their qualifying sea service, have passed Part A of the examination for a certificate of competency as Second Engineer-Officer or who have obtained a certificate, diploma or

behaal het wat deur die Sekretaris erken word as 'n sertifikaat, diploma of graad waarby volle of gedeeltelike vrystelling van deel A van die eksamen vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier verleen word, kan kwytskelding verkry van hoogstens drie maande ten opsigte van die seediens wat vereis word.

B. KWALIFIKASIES WAT VEREIS WORD VAN 'N KANDIDAAT VIR 'N BEKWAAMHEIDCERTIFIKAAT AS HOOF-INGENIEUROFFISIER EN ENDOSSEMENT.

Seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

24. 'n Kandidaat vir 'n bekwaamheidsertifikaat (stoom, of motor) as hoof-ingenieuroffisier moet, behoudens die bepalings van regulasie 28, in besit wees van 'n geldige bekwaamheidsertifikaat (stoom, of motor) as tweede ingenieuroffisier en moet, terwyl hy in besit was van so 'n sertifikaat, die tydperk van seediens wat ooreenkomstig regulasie 20 vereis word, voltooi het.

Seediens wat vereis word vir die endossement van 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

25. 'n Kandidaat vir die endossement van 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier moet die tydperk van seediens voltooi het wat ooreenkomstig regulasie 21 vereis word vir die endossement van 'n bekwaamheidsertifikaat (stoom, of motor, na gelang van die geval) as tweede ingenieuroffisier.

Soort seediens wat vereis word van 'n kandidaat vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

26. (1) Die seediens wat ooreenkomstig regulasies 24 en 25 vereis word, moes verrig gewees het in skepe van minstens 560 perdekrag wat lang-seereise onderneem, as 'n ingenieuroffisier ter see op gereelde waghoudiens vir minstens agt uur uit elke diens van vier-en-twintig uur waarop daar aanspraak gemaak word. Hierdie diens moes verrig gewees het as senior ingenieur in bevel van die hele wag, maar diens as tweede in voorrang op skepe wat deur twee of meer stelle masjiene aangedryf word, of op groot enkelskroefskepe waar drie of meer ingenieuroffisiere tegelykertyd gereelde waghoudiens verrig, word aanvaar teen volle waarde.

(2) Waar 'n kandidaat diens gedoen het in skepe wat aangedryf word deur twee of meer stelle masjiene of in groot enkelskroefskepe maar in graderings laer as die waarvan in paragraaf (1) melding gemaak word, tel sy seediens slegs as die helfte.

(3) Dagwerk word nie aanvaar nie.

(LET WEL.—Die aandag word gevestig op regulasie 31 waarin die voorwaardes uiteengesit word waarop toegelaat kan word dat diens wat verrig word in skepe, uitgesonderd skepe wat lang-seereise onderneem, as seediens gereken word.)

Kwytskelding van seediens vir hoof-ingenieuroffisier.

27. 'n Kandidaat vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier wat, voor die aanvang van sy kwalifiserende seediens, geslaag het in deel A van die eksamen vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier of wat 'n sertifikaat, diploma of graad behaal het wat deur die Sekretaris erken word as 'n sertifikaat, diploma of graad waarby volle of gedeeltelike vrystelling van deel A van die eksamen vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier verleen word, kan kwytskelding verkry van hoogstens drie maande ten opsigte van die seediens wat vereis word.

Eksamen sonder die voorlegging van 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.

28. (1) 'n Kandidaat vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier wat, as gevolg van diens in die buiteland, nie die geleentheid gehad het om 'n geldige bekwaamheidsertifikaat as tweede ingenieuroffisier te verkry nie, kan, behoudens die bepalings van paragraaf (2), toegelaat word tot die eksamen vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier: Met dien verstande

degree recognised by the Secretary as conferring full or partial exemption from Part A of the examination for a certificate of competency as Second Engineer-Officer, may be granted a remission of sea service not exceeding three months.

B.—QUALIFICATIONS REQUIRED OF CANDIDATES FOR CERTIFICATES OF COMPETENCY AS CHIEF ENGINEER-OFFICER AND ENDORSEMENT.

Sea Service required of a Candidate for a Certificate of Competency as Chief Engineer-Officer.

24. A candidate for a certificate of competency (steam or motor) as Chief Engineer-Officer shall, subject to the provisions of regulation 28, hold a valid certificate of competency (steam or motor) as Second Engineer-Officer, and, whilst holding such a certificate shall have completed the period of service required in terms of regulation 20.

Sea Service required for Endorsement of a Certificate of Competency as Chief Engineer-Officer.

25. A candidate for the endorsement of a certificate of competency as Chief Engineer-Officer shall have completed the period of sea service required in terms of regulation 21 for the endorsement of a certificate of competency (steam or motor, as the case may be) as Second Engineer-Officer.

Type of Sea Service required of a Candidate for a Certificate of Competency as Chief Engineer-Officer.

26. (1) The sea service required in terms of regulations 24 and 25 shall have been performed in ships of not less than 560 horsepower making long voyages, as an Engineer-Officer at sea on regular watch for not less than eight hours out of every twenty-four hours' service claimed. This service shall have been performed as senior Engineer in charge of the entire watch, but service as second in seniority on ships propelled by two or more sets of engines, or in large single screw-ships where there are three or more Engineer-Officers on regular watch at the same time, shall be accepted at full-time value.

(2) Where a candidate has served on ships propelled by two or more sets of engines or in large single screw-ships but in ranks below those referred to in paragraph (1), his sea service shall count at half rate only.

(3) Day work shall not be accepted.

(NOTE.—Attention is invited to regulation 31 in which are set out the conditions under which service performed in ships other than ships making long voyages may be allowed to count.)

Remission of Sea Service for Chief Engineer-Officers.

27. Candidates for certificates of competency as Chief Engineer-Officer who, before commencing their qualifying sea service, have passed Part A of the examination for a certificate of competency as Chief Engineer-Officer or, who have obtained a certificate, diploma or degree recognised by the Secretary as conferring full or partial exemption from Part A of the examination for a certificate of competency as Chief Engineer-Officer, may be granted a remission of sea service not exceeding three months.

Examination without production of a Certificate of Competency as Second Engineer-Officer.

28. (1) A candidate for a certificate of competency as Chief Engineer-Officer who, in consequence of service abroad, has had no opportunity to obtain a valid certificate of competency as Second Engineer-Officer, may, subject to the provisions of paragraph (2), be admitted to the examination for a certificate of competency as Chief Engineer-Officer: Provided the Secretary

dat die Sekretaris oortuig is dat die aard van die kandidaat se diens, vakleerlingskap of tegniese studies, insluitende werkswinkeldiens, gelykwaardig is aan 'n standaard nie laer nie as die wat vereis word vir die uitreiking ingevolge hierdie regulasies van 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier.

(2) 'n Kandidaat van wie in paragraaf (1) melding gemaak word, moet bewys lewer dat hy vir minstens vier jaar diens gedoen het in stoomskepe van minstens 560 perdekrags wat lang-seereise onderneem, waarvan minstens agtien maande uitgedien moes gewees het in bevel van die hele wag by die ketels en hoofaandryfmasjinerie van 'n stoomskip of by die hoofaandryfmasjinerie van 'n motorskip, en moet slaag in die eksamen vir tekene wat by subparagraaf (d) van deel A van paragraaf (2) van regulasie 37 voorgeskryf word.

(3) As 'n kandidaat van wie in paragraaf (1) melding gemaak word, in die eksamen vir 'n bekwaamheidsertifikaat as hoof-ingenieuroffisier drui, maar bewys lewer dat hy die standaard behaal het wat vereis word vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier, kan die Minister so 'n sertifikaat aan hom uitreik: Met dien verstande dat geen gedeelte van die eksamengelde aan hom terugbetaal word nie.

(C) ALGEMENE BEPALINGS WAT BETREFF BENOEMBAARHEID.

Algemeen.

29. (1) Die bewyslas om aanneembare bewys van seediens te lewer rus in alle gevalle op die kandidaat wat op dergelike seediens aanspraak maak.

(2) As 'n kandidaat aanspraak maak op seediens wat verrig is in skepe wat nie in die Unie geregistreer is nie en dergelike diens nie deur die Sekretaris geverifieer kan word nie, moet die diens bevestig word deur 'n amptelike gesag van die land aan wie die skip waarin die kandidaat diens gedoen het, behoort. Indien daar enige twyfel bestaan dat die bewyse gelewer voldoende is, word alle dokumente vir beslissing na die Sekretaris verwys.

(3) Slegs diens wat volgens 'n ooreenkoms met die bemanning verrig is, word as seediens getel.

(4) Wanneer 'n gedeelte of die hele tydperk van kwalifiserende diens verrig is in skepe wat vir aansienlike tydperke nie ter see gevaar het nie, moet 'n kandidaat 'n sertifikaat van die eienaars van die skip voorleë waarin die gedeelte van die diens tydperk wat werklik ter see deurgebring is, vermeld word. As hierdie diens tydperk gelyk is aan minstens twee-derdes van die seediens wat vereis word om vir die eksamen te kwalifiseer, kan die diens ten volle aanvaar word, maar as die werklike diens ter see minder as hierdie tydbestek beslaan, moet die kandidaat vir die tekort vergoed deur addisionele seediens te verrig.

(5) Diens in skepe waar 'n waghoudende ingenieuroffisier as deel van sy gereelde pligte die werk van 'n stoker of ander werk moet verrig wat nie gewoonlik deur 'n ingenieuroffisier gedoen word nie, word nie as kwalifiserende diens aanvaar nie.

(6) Die Sekretaris kan gelas dat diens, vir die aanvaarding waarvan daar nie in hierdie regulasies voorsiening gemaak word nie, as seediens erken moet word, en hy kan bepaal watter gedeelte van diens wat aldus verrig word as seediens gereken moet word.

Hoe seediens bereken word.

30. Die kandidaat se diens, soos in sy ontslagsertifikaat aangetoon, word volgens kalendermaande gereken, d.w.s. die tyd ingesluit tussen enige bepaalde dag in enige maand en die voorafgaande dag van die volgende maand, albei ingesluit. Die aantal volle maande vanaf die aanvang van die tydperk, wat aldus vasgestel word, word bereken, en daarna word die aantal dae wat oorbly getel. Die dag waarop die ooreenkoms 'n aanvang neem, sowel as die dag waarop dit beëindig word, word albei ingesluit, en al die oorblywende dae word bymekaar getel en gereken teen 30 dae per maand.

is satisfied that the character of the candidate's service, apprenticeship or technical studies, including workshop service is of a standard not lower than that required for the grant under these regulations of a certificate of competency as Chief Engineer-Officer.

(2) A candidate referred to in paragraph (1) shall produce proof of having served for at least four years in steamships of not less than 560 horsepower making long voyages, of which at least eighteen months shall have been spent in charge of the entire watch on the boilers and main propelling machinery of a steamship or on the main propelling machinery of a motorship, and shall pass the examination for drawing prescribed by sub-paragraph (d) of Part A of paragraph (2) of regulation 37.

(3) If a candidate referred to in paragraph (1), fails to pass the examination for a certificate of competency as Chief Engineer-Officer, but shows that he has reached the standard required for a certificate of competency as Second Engineer-Officer, the Minister may grant him such a certificate: Provided that no part of the fee shall be refunded to him.

(C) GENERAL PROVISIONS AS TO ELIGIBILITY.

General.

29. (1) In all cases the onus of producing acceptable proof of sea service shall rest upon the candidate claiming such service.

(2) Where a candidate claims sea service performed in ships not registered in the Union and such service cannot be verified by the Secretary, the service shall be confirmed by an official authority of the country to which the ship in which the candidate served belonged. If the sufficiency of the proofs given appears to be at all doubtful, all papers shall be referred to the Secretary for decision.

(3) Only service rendered in terms of an agreement with the crew shall be reckoned as sea service.

(4) When part or the whole of the qualifying service has been performed in ships which for considerable periods have not been at sea, a candidate shall produce a certificate from the owners of the ship stating the proportion of time actually spent at sea. If this time amounts to not less than two-thirds of the sea service required to qualify for the examination, the service may be accepted in full, but where the actual service at sea falls below this proportion, the candidate shall be required to make up the deficiency by performing additional sea service.

(5) Service in ships where a watchkeeping Engineer-Officer is, as part of his regular duties, required to do stoking or other work not usually performed by an Engineer-Officer, shall not be accepted as qualifying.

(6) The Secretary may order that service, the acceptance of which is not provided for in these regulations, shall be recognised as sea service, and may determine what proportion of service so spent shall be counted as sea service.

How Sea Service is Calculated.

30. The candidate's service as shown on his discharges, shall be reckoned by the calendar month, i.e. the time included between any given day in any month and the preceding day of the following month, both inclusive. The number of complete months from the commencement of the period, ascertained in this way, shall be computed, after which the number of odd days shall be counted. The day on which the agreement commences, as well as that on which it terminates, shall both be included, and all odd days added together and reckoned at 30 to the month.

Diens in skepe op kort-seereise, vissers- of sleepbote.

31. (1) Diens in skepe wat kort-seereise onderneem, word vir die kwalifiserende tydperke van seediens by regulasie 20 voorgeskryf vir bekwaamheidsertifikate as twee-derdes aanvaar. Kandidate vir sertifikate as tweede ingenieur-offisiere mag al hul kwalifiserende seediens verrig op gereelde waghoudiens in skepe van minstens 375 perdekrags wat kort-seereise onderneem. Kandidate vir sertifikate as hoof-ingenieur-offisiere mag al hulle kwalifiserende seediens verrig in bevel van 'n wag in skepe van minstens 560 perdekrags wat kort-seereise onderneem.

(2) Behoudens die bepalinge van paragraaf (3), word diens in vissersbote of in seevarende sleepbote vir die kwalifiserende tydperke van seediens by regulasie 20 voorgeskryf vir bekwaamheidsertifikate as die helfte aanvaar.

(3) Kandidate vir sertifikate as tweede ingenieur-offisiere mag al hul kwalifiserende seediens verrig op gereelde waghoudiens in vissersbote of seevarende sleepbote van minstens 375 perdekrags. Kandidate vir sertifikate as hoof-ingenieur-offisiere moet, benewens hul diens in bevel van die wag in vissersbote of seevarende sleepbote van minstens 560 perdekrags, vir minstens ses maande in 'n kwalifiserende hoedanigheid [vergelyk regulasie 20 (2)] diens gedoen het in skepe van minstens 560 perdekrags wat lang-seereise onderneem of vir minstens nege maande in skepe van minstens 560 perdekrags wat kort-seereise onderneem.

Diens verrig by hulpmasjinerie.

32. (1) Behoudens die bepalinge betreffende die minimum-diens by ketels en hoofmasjiene in regulasie 20 uiteengesit, tel tyd wat uitgedien word by hulpmasjinerie wat saam met die hoofaandryfmasjinerie werk (bv. by hulpmasjiene wat noodsaaklik is vir die aandryf van die hoofaandryfmasjinerie of ketels) ten volle vir die kwalifiserende tydperk van seediens.

(2) Tyd wat uitgedien word by geskikte hulpmasjiene wat onafhanklik werk van die hoofaandryfmasjinerie tel as die helfte.

HOOFSTUK III.

EKSAMENGELDE.

Wanneer betaalbaar.

33. 'n Kandidaat wat 'n eksamen vir 'n bekwaamheidsertifikaat wil aflê, moet die eksamengelde voor die datum van die eksamen betaal, en geen kandidaat word tof die eksamen toegelaat nie tensy hy aan die eksaminator 'n kwitansie vir die eksamengelde vertoon.

Waar betaalbaar.

34. Die eksamengelde moet aan die naaste bevoegde beampte betaal word, wat 'n kwitansie moet uitreik met vermelding van—

- die naam van die kandidaat;
- die bedrag wat betaal is; en
- die graad van die eksamen.

Tabel van eksamengelde.

35. Ondervermelde gelde moet betaal word—

- Tweede ingenieur-offisiereksamen (stoom, of motor, of gekombineerde stoom en motor):—

	£	s.	d.
(i) Vir die volle eksamen (stoom, of motor, of gekombineerde stoom en motor).....	2	0	0
(ii) Deel A of deel B of 'n gedeelte van deel A of deel B, of vir vrystelling van geheel deel A....	1	0	0
(iii) Eksamen vir endossering van sertifikaat (stoom, of motor).....	1	0	0

Service in Ships making Short Voyages, Fishing Boats or Tugs.

31. (1) Service in ships making short voyages shall be accepted towards the qualifying periods of sea service prescribed by regulation 20 for certificates of competency at two-thirds rate. Candidates for Second Engineer-Officers' certificates may perform all their qualifying sea service on regular watch in ships of not less than 375 horse-power making short voyages. Candidates for Chief Engineer-Officers' certificates may perform all their qualifying sea service in charge of a watch in ships of not less than 560 horse-power making short voyages.

(2) Subject to the provisions of paragraph (3), service in fishing boats or in sea-going tugs shall be accepted towards the qualifying periods of sea service prescribed by regulation 20 for certificates of competency at half rate.

(3) Candidates for Second Engineer-Officers' Certificates may perform all their qualifying sea service on regular watch in fishing boats or sea-going tugs of not less than 375 horse-power. Candidates for Chief Engineer-Officers' certificates shall, in addition to their service in charge of the watch in fishing boats or sea-going tugs of not less than 560 horse-power, have served in a qualifying capacity [see regulation 20 (2)] for not less than six months in ships of not less than 560 horse-power making long voyages or for not less than nine months in ships of not less than 560 horse-power making short voyages.

Service on Auxiliary Machinery.

32. (1) Time served on auxiliary machinery run in conjunction with the main propelling machinery (i.e. on auxiliaries which are essential to the running of the main propelling machinery or boilers) shall, subject to the provisions regarding the minimum service on boilers and main engines set out in regulation 20, count in full towards the qualifying period of sea service.

(2) Time served on suitable auxiliaries run independently of the main propelling machinery shall count at half rate.

CHAPTER III.

EXAMINATION FEES.

When to Pay Fees.

33. A candidate for examination for a certificate of competency shall pay the examination fee prior to the date of the examination, and no candidate shall be allowed to sit for the examination unless he produces to the examiner the receipt for the fees paid.

Where to Pay Fees.

34. The fee for examination shall be paid to the nearest proper officer who shall issue a receipt stating—

- the name of the candidate;
- the amount paid; and
- the grade of the examination.

Table of Fees.

35. The fees payable shall be as follows:—

- Second Engineer-Officers' examination (steam or motor, or combined steam and motor):—

	£	s.	d.
(i) The full examination (steam or motor, or combined steam and motor).....	2	0	0
(ii) Part A or Part B or a portion of either Part, or for exemption from all of Part A.....	1	0	0
(iii) The endorsement (steam or motor) examination.....	1	0	0

(b) Hoof-ingeneuroffisierseksamen (stoom, of motor, of gekombineerde stoom en motor):—

	£	s.	d.
(i) Vir die volle eksamen (stoom, of motor, of gekombineerde stoom en motor).....	4	0	0
(ii) Deel A of deel B of 'n gedeelte van deel A of deel B.....	2	0	0
(iii) Eksamen vir endossering van sertifikaat (stoom, of motor).....	2	0	0

Terugbetaling van eksamengelde.

36. (1) As 'n kandidaat deur omstandighede buite sy beheer nie in staat is om 'n eksamen waarvoor hy gelde betaal het, af te lê nie, kan hy skriftelik by die bevoegde beampte aansoek doen om terugbetaling van die gelde. As die bevoegde beampte van mening is dat die aansoek op redelike gronde berus, moet hy dit aan die Sekretaris deurstuur, wat die terugbetaling kan magtig.

(2) As 'n kandidaat ingevolge regulasie 11 nie toegelaat word om die eksamen te voltooi nie, kan hy skriftelik by die bevoegde beampte aansoek doen om terugbetaling van die gelde wat hy betaal het, en die gelde word dan aan hom terugbetaal.

(3) As 'n kandidaat nie in enige gedeelte van die eksamen slaag nie word, behoudens die bepalings van paragraaf (2), geen deel van die gelde aan hom terugbetaal nie.

HOOFSTUK IV.**EKSAMENS.****Eksamen vir 'n bekwaamheidsertifikaat as tweede ingenieuroffisier.**

37. (1) Die leerplanne vir hierdie eksamen word in Bylae C uiteengesit.

(2) Die eksamen word in twee dele verdeel, soos volg:—

Deel A.

- (a) Toegepaste meganika (een vraestel van drie uur).
- (b) Hitte en hitte-motore (een vraestel van drie uur).
- (c) Wiskunde (een vraestel van drie uur).
- (d) Tekene (een vraestel van ses uur).

Deel B.

- (a) (i) Elektrotegniek (een vraestel van drie uur).
- (ii) Elementêre skeepsontwerp (een vraestel van drie uur).
- (b) (i) Ingenieurswese (twee vraestelle elk van drie uur).
- (ii) Mondeling.

(3) Kandidate kan vrygestel word van deel A of 'n gedeelte daarvan en kan die eksamen in afsonderlike dele soos volg aflê:—

- (a) 'n Kandidaat wat 'n goedgekeurde instruksiekursus gevolg het wat minstens drie van die vier vakke wat in deel A ingesluit word, dek, en wat 'n sertifikaat verkry het met die strekking dat hy in die

(b) Chief Engineer-Officer's examination (steam or motor, or combined steam and motor):—

	£	s.	d.
(i) The full examination (steam or motor, or combined steam and motor).....	4	0	0
(ii) Part A or Part B or a portion of either Part...	2	0	0
(iii) The endorsement (steam or motor) examination	2	0	0

Refund of Fees.

36. (1) If through circumstances beyond the control of a candidate he is unable to undergo the examination for which fees have been paid, he may apply in writing to the proper officer for a refund of such fees. If the proper officer considers that the application is based upon reasonable grounds, he shall transmit it to the Secretary, who may authorise the refund.

(2) If a candidate is, in terms of regulation 11, not allowed to complete an examination, he may apply in writing to the proper officer for a refund of the fees paid by him, and such fees shall be refunded to him.

(3) Subject to the provisions of paragraph (2), if a candidate fails to pass any part of the examination, no part of the fee shall be refunded to him.

CHAPTER IV.**EXAMINATIONS.****Examination for a Certificate of Competency as Second Engineer-Officer.**

37. (1) The syllabuses for this examination are set out in Annex C.

(2) The examination is divided into two parts as follows:—

Part A.

- (a) Applied Mechanics (one paper of three hours).
- (b) Heat and Heat Engines (one paper of three hours).
- (c) Mathematics (one paper of three hours).
- (d) Drawing (one paper of six hours).

Part B.

- (a) (i) Electrotechnology (one paper of three hours).
- (ii) Elementary Naval Architecture (one paper of three hours).
- (b) (i) Engineering Knowledge (two papers, each of three hours).
- (ii) Oral.

(3) Candidates may be exempted from Part A or some portion of it and may take the examination in separate parts as follows:—

- (a) A candidate who has attended an approved course of instruction which covers not less than three of the four subjects included in Part A, and who has obtained a certificate stating that he has passed the

toepaslike eksamen aan die einde van die kursus geslaag het, word vrygestel van die vak in deel A wat deur dié sertifikaat gedek word.

(LET WEL—

Opleidingsinrigting.
Tegniese Kolleges in die Unie

Berekening van waarde van kursusse.

Die Gevorderde Tegniese Sertifikaat II en die Nasionale Ingenieursdiploma kan aanvaar word vir die doel om kandidate vry te stel van deel A van die eksamens vir bekwaamheidsertifikate as tweede ingenieur-offisier. Gedeeltelike vrystelling kan verleen word op 'n vak-vir-vak-basis vir elke groep van drie van die vereiste vakke, mits Wiskunde V in die groep ingesluit is.)

- (b) 'n Kandidaat kan hom of vir deel A van die eksamen in sy geheel aanmeld of as hy ingevolge subparagraaf (a) hierbo van drie van die eksamenvakke vrygestel was, vir die oorblywende vak te eniger tyd nadat hy die vereiste werkswinkeldiens voltooi het.
- (c) 'n Kandidaat wat nie ingevolge subparagraaf (a) hierbo van deel A of 'n gedeelte daarvan vrygestel is nie en wat slegs in een vak slaag wanneer hy deel A van die eksamen aflê, moet by hereksamen in die deel in sy geheel eksamen aflê. As hy in twee of drie vakke slaag, sal nie van hom verlang word dat hy daardie vakke moet herhaal nie, en hy kan hom vir hereksamen in die oorblywende vak of vakke aanmeld.
- (d) 'n Kandidaat kan deel B van die eksamen te eniger tyd aflê nadat hy die vereiste tydperke van kwalifiserende werkswinkel- en seediens voltooi het, mits hy ook terselfdertyd deel A van die eksamen in sy geheel aflê of eksamen doen in dié vakke, indien enige, in daardie deel waarin hy nie reeds geslaag het nie of waarvan hy nie ingevolge subparagraaf (a) hierbo vrystelling verkry het nie.
- (e) 'n Kandidaat slaag nie in deel B of enige afdeling van deel B nie, tensy hy deel A en deel B tegelykertyd voltooi of tensy hy deel A voorheen voltooi het, of daarvan vrygestel is.
- (f) 'n Kandidaat wat deel A voltooi of voltooi het en wat, wanneer hy deel B van die eksamen aflê, in afdeling (a) (elektrotegniek en elementêre skeepsontwerp) slaag maar in afdeling (b) (ingenieurswese en mondeling) druip, ontvang 'n slaagmerk in afdeling (a) en kan in afdeling (b) 'n hereksamen aflê.
- (g) 'n Kandidaat wat deel A voltooi of voltooi het en wat, wanneer hy deel B van die eksamen aflê in afdeling (b) (ingenieurswese en mondeling) slaag maar in afdeling (a) (elektrotegniek en elementêre skeepsontwerp) druip, ontvang 'n slaagmerk in afdeling (b) en kan in afdeling (a) 'n hereksamen aflê.

Eksamen vir 'n bekwaamheidsertifikaat as hoof-ingenieur-offisier.

38. (1) Die leerplanne vir hierdie eksamen word in Bylae C uiteengesit.

(2) Die eksamen word in twee dele verdeel, soos volg:—

Deel A.

- (a) Toegepaste meganika (een vraestel van drie uur).
- (b) Hitte en hitte-motore (een vraestel van drie uur).

appropriate examination at the termination of the course, shall be granted exemption from the subject in Part A covered by the certificate.

(NOTE—

Training Establishment.
Technical Colleges in the Union

Assessment of Courses.

The Advanced Technical Certificate II and the National Engineering Diploma may be accepted for the purpose of granting candidates exemption from Part A of the examinations for certificates of competency as Second Engineer-Officer. Partial exemption may be granted on a subject-for-subject basis for any group of three of the required subjects, provided Mathematics V is included in the group.)

- (b) A candidate may present himself either for the whole of Part A of the examination, or, if he has been exempted under sub-paragraph (a) above from three subjects of the examination, for the remaining subject at any time after he has completed the necessary workshop service.
- (c) A candidate who has not been exempted under (a) above from Part A or a part of it, and who, when taking Part A of the examination, passes in one subject only, must sit for the whole part on re-examination. If he passes in two or three subjects, he will not be required to take those subjects again and may present himself for re-examination in the remaining subject or subjects.
- (d) A candidate may take Part B at any time after he has completed the necessary periods of qualifying workshop and sea service, provided he also takes at the same time the whole of Part A of the examination or such subjects, if any, in that Part in which he has not already passed or from which he has not been exempted under sub-paragraph (a) above.
- (e) A candidate shall not be given a pass in Part B or in either section of Part B unless he completes Part A at the same time as Part B or unless he has previously completed it, or has been exempted from it.
- (f) A candidate who completes, or has completed, Part A and who, when taking Part B, passes in section (a) (Electrotechnology and Elementary Naval Architecture), but fails in section (b) (Engineering Knowledge and Oral), shall be given a pass in section (a) and may sit for re-examination in section (b).
- (g) A candidate who completes, or has completed, Part A and who, when taking Part B, passes in section (b) (Engineering Knowledge and Oral) but fails in section (a) (Electrotechnology and Elementary Naval Architecture), shall be given a pass in section (b) and may sit for re-examination in section (a).

Examination for a Certificate of Competency as Chief Engineer-Officer.

38. (1) The syllabuses for this examination are set out in Annex C.

(2) The examination is divided into two parts as follows:—

Part A.

- (a) Applied Mechanics (one paper of three hours).
- (b) Heat and Heat Engines (one paper of three hours).

Deel B.

- (a) (i) Elektrotegniek (een vraestel van drie uur).
 (ii) Elementêre skeepsontwerp (een vraestel van drie uur).
 (b) (i) Ingenieurswese [twee vraestelle van drie uur elk: Met dien verstande dat 'n derde vraestel van drie uur beantwoord moet word in die eksamen vir 'n gekombineerde sertifikaat (stoom en motor)].
 (ii) Mondeling.

(3) Kandidate kan vrygestel word van deel A of van 'n gedeelte daarvan en kan die eksamen in afsonderlike dele soos volg aflê:—

- (a) 'n Kandidaat wat vrystelling verkry het van die tweede ingenieuroffisierseksamen in toegepaste meganika of hitte en hitte-motore, of in albei, word ook vrygestel van hierdie eksamen in enige van of in albei bogemelde vakke.

(LET WEL—

Opleidingsinrigting.
 Tegniese Kolleges in die Unie

Berekening van waarde van kursusse.
 Die Gevorderde Tegniese Sertifikaat II en die Nasionale Ingenieursdiploma kan aanvaar word vir die doel om kandidate vry te stel van deel A van die eksamens vir bekwaamheidsertifikate as hoof-ingenieuroffisier. Gedeeltelike vrystelling kan verleen word op 'n vak-vir-vak-basis vir elke groep van drie van die vereiste vakke, mits Wiskunde V in die groep ingesluit is.)

- (b) 'n Kandidaat wat in besit is van 'n bekwaamheid-sertifikaat as tweede ingenieuroffisier kan of deel A van die eksamen in sy geheel aflê of, indien hy ingevolge subparagraaf (a) hierbo van een vak vrygestel is, kan hy in die oorblywende vak eksamen doen.
 (c) Van 'n kandidaat wat nie ingevolge subparagraaf (a) hierbo van deel A of 'n gedeelte daarvan vrygestel is nie en wat, wanneer hy deel A van die eksamen aflê, slegs in een vak slaag, sal nie verlang word dat hy weer in daardie vak eksamen moet doen nie en hy kan 'n eksamen in die oorblywende vak aflê.
 (d) 'n Kandidaat kan deel B van die eksamen te eniger tyd aflê mits hy in besit is van 'n bekwaamheid-sertifikaat as tweede ingenieuroffisier en die vereiste tydperk van kwalifiserende seediens voltooi het, en mits hy ook terselfdertyd eksamen doen in deel A van die eksamen in sy geheel of in dié vak, indien enige, in daardie deel waarin hy nie reeds geslaag het nie of waarvan hy nie ingevolge subparagraaf (a) hierbo vrystelling verkry het nie.
 (e) 'n Kandidaat slaag nie in deel B van die eksamen of in enige afdeling van deel B nie, tensy hy deel A en deel B terselfdertyd voltooi of tensy hy deel A voorheen voltooi het, of daarvan vrygestel is.
 (f) 'n Kandidaat wat deel A voltooi of voltooi het en wat, wanneer hy deel B van die eksamen aflê, in afdeling (a) (elektrotegniek en elementêre skeepsontwerp) slaag maar in afdeling (b) (ingenieurswese en mondeling) druip, ontvang 'n slaagmerk in afdeling (a) en kan in afdeling (b) hereksamen doen.

Part B.

- (a) (i) Electrotechnology (one paper of three hours).
 (ii) Elementary Naval Architecture (one paper of three hours).
 (b) (i) Engineering Knowledge [two papers, each of three hours: Provided that in the examination for a combined certificate (steam and motor) a third paper of three hours is set.]
 (ii) Oral.

(3) Candidates may be exempted from Part A or from a part of it and may take the examination in separate parts as follows:—

- (a) A candidate who has been exempted from the Second Engineer-Officer examination in Applied Mechanics or Heat and Heat Engines, or both, shall also be exempted from this examination in either or both of the above-mentioned subjects.

(NOTE—

Training Establishment.
 Technical Colleges in the Union

Assessment of Courses.
 The Advanced Technical Certificate II and the National Engineering Diploma may be accepted for the purpose of granting candidates exemption from Part A of the examinations for certificates of competency as Chief Engineer-Officer. Partial exemption may be granted on a subject-for-subject basis for any group of three of the required subjects, provided Mathematics V is included in the group.)

- (b) A candidate possessing a Second Engineer-Officer's certificate of competency may take either the whole of Part A or, if exempted under sub-paragraph (a) above from one subject, the remaining subject.
 (c) A candidate who has not been exempted under sub-paragraph (a) above from Part A or part of it and who, when taking Part A, passes in one subject only, shall not be required to take that subject again and may sit for the remaining subject.
 (d) A candidate may take Part B at any time provided he holds a certificate of competency as Second Engineer-Officer and has completed the necessary period of qualifying sea service, and provided also that he takes at the same time either the whole of Part A of the examination or such subject, if any, in that Part in which he has not already passed or from which he has not been exempted under sub-paragraph (a) above.
 (e) A candidate shall not be given a pass in Part B or in either section of Part B unless he completes Part A at the same time as Part B or unless he has previously completed it, or has been exempted from it.
 (f) A candidate who completes, or has completed, Part A and who, when taking Part B, passes in section (a) (Electrotechnology and Elementary Naval Architecture), but fails in section (b) (Engineering Knowledge and Oral), shall be given a pass in section (a) and may sit for re-examination in section (b).

- (g) 'n Kandidaat wat deel A van die eksamen voltooi of voltooi het en wat, wanneer hy deel B van die eksamen aflê, in afdeling (b) (ingenieurswese en mondeling) slaag maar in afdeling (a) (elektro- tegniek en elementêre skeepsontwerp) druip, ontvang 'n slaagmerk in afdeling (b) en kan te eniger tyd in afdeling (a) hereksamen doen.

Eksamen vir endossering van sertifikate van tweede en hoof-ingenieur-offisier.

39. Die eksamen sluit die volgende in:—

- (a) Een vraestel van drie uur oor ingenieurswese.
- (b) Mondeling.

Die leerplanne vir hierdie eksamens word in Bylae C uiteengesit.

Vereiste punte om te slaag.

40. (1) Ten einde in die skriftelike gedeelte van die eksamen te slaag, moet 'n kandidaat 'n minimum aantal punte in elke vak behaal en ook minstens een-helfte van die totale aantal punte vir alle vakke. In die mondelinge eksamen word 'n hoër standaard vereis.

(2) Die eksaminator sal die uitslag van die eksamen aan die kandidaat meedeel.

Druip in eksamen.

41. (1) As 'n kandidaat druip in 'n eksamenvak waar gebrek aan kennis van die vak daartoe mag lei dat 'n ingenieur-offisier iets mag doen wat werklik onveilig is vir die bestuur van enige gedeelte van die skip se masjinerie of mag versuim om iets noodsaakliks te doen in die belange van veiligheid (bv. as hy druip in vraestelle oor die manipulering en die lees van die waterpeilglas, die gevare van brand en ontploffing in stoom- en motorvaartuie), word daar geag dat hy gedruip het in praktiese kennis, en 'n kandidaat wat aldus druip mag hom nie vir hereksamen aanmeld voordat hy bewys lewer dat hy verdere seediens in 'n kwalifiserende hoedanigheid verrig het nie.

(2) 'n Kandidaat wat in 'n eksamen druip as gevolg van gebrek aan kennis van fundamentele beginsels of vanweë algemene ondoeltreffendheid in die eksamen, mag hom vir 'n tydperk van tot drie maande, wat deur die eksaminator vasgestel moet word, nie vir hereksamen aanmeld nie: Met dien verstande dat die Sekretaris na goeëddunke, behoudens die bepalings van paragraaf (5), die tydperk op meer as drie maande kan vasstel.

(3) 'n Kandidaat wat in 'n eksamen druip in omstandighede uitgesonderd die wat in paragrawe (1) en (2) van hierdie regulasie uiteengesit word, mag homself te eniger tyd nadat een maand verstryk het sedert sy vorige poging, vir hereksamen aanmeld, maar as hy drie keer in deel A of drie keer in deel B druip binne enige tydperk van drie maande, word hy vir 'n tydperk van tot drie maande, wat deur die eksaminator vasgestel moet word, nie weer geëksamineer nie: Met dien verstande dat die Sekretaris na eie goeëddunke, behoudens die bepalings van paragraaf (5), die tydperk op meer as drie maande kan vasstel.

(4) Die tydperk van verdere seediens wat ingevolge paragraaf (1) van hierdie regulasie vereis word, word deur die eksaminator vasgestel en is hoogstens drie maande

- (g) A candidate who completes, or has completed, Part A and who, when taking Part B, passed in section (b) (Engineering Knowledge and Oral), but fails in section (a) (Electrotechnology and Elementary Naval Architecture), shall be given a pass in section (b) and may sit for re-examination in section (a) at any time.

Examination for Endorsement of Second and Chief Engineer-Officers' Certificates.

39. The examination shall consist of:—

- (a) One written paper of three hours in Engineering Knowledge.
- (b) Oral.

The syllabuses for these examinations are set out in Annex C.

Marks required for Pass.

40. (1) To secure a pass in the written portion of the examination, a candidate shall be required to obtain a minimum number of marks in each subject and also to obtain not less than one-half of the total number of marks for all subjects. In the oral examination a higher standard will be required.

(2) The result of the examination will be communicated to the candidate by the examiner.

Failure in Examination.

41. (1) Failure in a subject in an examination, ignorance of which may lead an Engineer-Officer to do something actually unsafe in the management of any part of a ship's machinery or to fail to do something essential in the interests of safety (e.g. failure in questions on manipulation and reading of the water-gauge, the danger of fire and explosion in steam and motor vessels), shall be regarded as failure in practical knowledge, and a candidate so failing shall not present himself for re-examination until he produces proof of further sea service in a qualifying capacity.

(2) A candidate who fails in an examination through ignorance of fundamental principles or on account of general defectiveness in the examination shall not present himself for re-examination for a period of up to three months, to be determined by the examiner: Provided that the Secretary in his discretion may, subject to the provisions of paragraph (5), fix a period in excess of three months.

(3) A candidate who fails in an examination in circumstances other than those set out in paragraphs (1) and (2) of this regulation may present himself for examination at any time after one month has elapsed since his previous attempt, but if he fails three times in Part A or three times in Part B within any period of three months he shall not be examined for a period of up to three months to be determined by the examiner: Provided that the Secretary in his discretion may, subject to the provisions of paragraph (5), fix a period in excess of three months.

(4) The period of further sea service required in terms of paragraph (1) of this regulation shall be determined by the examiner and shall not exceed three months, unless, in

tensy, in 'n geval waar die eksaminator die mening toegedaan is dat 'n dienstdyner van meer as drie maande geregtig is, die goedkeuring van die Sekretaris vooraf daartoe verkry word.

(5) Die tydperk wat moet verstryk voordat 'n kandidaat hom vir 'n herkamen kan aanmeld en wat deur die Sekretaris ingevolge paragraaf (2) of (3) vasgestel word, of die tydperk van verdere seediens, wat ingevolge paragraaf (4) van hierdie regulasie vereis word, is in geen geval meer as ses maande nie.

Erkenning van gedeeltelike slaagpunte in eksamens wat in ander dele van die Statebond gehou is.

42. Gedeeltelike slaagpunte in 'n eksamen vir 'n bekwaamheidsertifikaat as ingenieuroffisier of vir endosering van 'n tweede of hoof-ingenieuroffisier se sertifikaat wat in 'n ander deel van die Statebond behalwe die Unie behaal is, word vir die doel van die ooreenstemmende eksamen in die Unie aanvaar, en die bepalinge van hierdie Hoofstuk is ten opsigte van sodanige gedeeltelike slaagpunte van toepassing.

HOOFTUK V.

HOU VAN EKSAMENS.

Kandidate moet stip op tyd wees.

43. Kandidate moet stip op die vasgestelde tyd in die eksamenkamer aanwesig wees.

Geen vreemdelinge word toegelaat nie.

44. Niemand word in die kamer tydens die afneem van 'n eksamen toegelaat nie, behalwe diegene wat pligmatig teenwoordig mag wees. Geen instruksies word tydens die hou van 'n eksamen op die perseel toegelaat nie.

Stilte.

45. Terwyl 'n skriftelike eksamen afgeneem word, moet daar stilte in die eksamenkamer bewaar word.

Los velle papier en boeke.

46. Voor die aanvang van die eksamen moet alle stukke papier en boeke, uitgesonderd dié wat ingevolge hierdie regulasies in die eksamenkamer veroorloof is, van die tafels of lessenaars verwyder word.

Gebruik van matematiese tafels.

47. 'n Kandidaat mag geen ander matematiese tafels, uitgesonderd dié wat deur die eksaminator verskaf word, gebruik nie.

Gebruik van instrumente.

48. (1) Tekenborde en tekenhake wat vir gebruik by die eksamens benodig word, sal deur die eksaminator verskaf word, maar kandidate moet hul eie tekeninstrumente verskaf.

(2) Kandidate wat rekenliniale vir hul berekenings gebruik, moet in ink in hul antwoordboeke volledig aantoon hoedat hulle te werk gegaan het om die resultate te verkry. As hul metode van werk nie aldus aangetoon word nie, word geen punte toegeken ten opsigte van die betrokke resultate nie.

a case where the examiner is of the opinion that a period of service in excess of three months is warranted, the prior approval of the Secretary has been obtained.

(5) The period of time which must elapse before a candidate may again present himself for examination and which is fixed by the Secretary in terms of paragraphs (2) or (3), or the period of further sea service required in terms of paragraph (4) of this regulation shall in no case exceed six months.

Recognition of Partial Passes at Examinations held in Other Parts of the Commonwealth.

42. A partial pass in an examination for a certificate of competency as an Engineer-Officer or for endorsement of a Second or Chief Engineer-Officer's certificate obtained in a part of the Commonwealth other than the Union shall be accepted for the purpose of the corresponding examination in the Union, and the provisions of this Chapter shall apply in respect of such pass.

CHAPTER V.

CONDUCT OF EXAMINATIONS.

Candidates to be punctual.

43. Candidates shall appear at the examination room punctually at the time appointed.

No Strangers Admitted.

44. No persons other than those whose duties require them to be present shall be allowed in the room during examination. No instructors shall be allowed on the premises while examinations are in progress.

Silence.

45. Silence shall be kept in the examination room while a written examination is in progress.

Loose Papers and Books.

46. Before the examination begins, the tables or desks shall be cleared of all scraps of paper and books other than those permitted in the examination room in terms of these regulations.

Use of Mathematical Tables.

47. A candidate shall not use any mathematical tables other than those provided by the examiner.

Use of Instruments.

48. (1) Drawing boards and T. squares necessary for use in the examinations will be supplied by the examiner, but candidates shall provide their own drawing instruments.

(2) Candidates who use slide rules for their calculations shall show in ink on the answer papers the full working statement necessary for arriving at the results. If the statement is not so shown, no marks will be given in respect of the results concerned.

Ongemagtigde boeke en geskrifte is streng verbode.

49. Kandidate mag geen boeke, aantekeninge, memoranda of geskrifte, uitgesonderd dié wat vir gebruik by die eksamen verskaf is, by hulle hê nie. Ingeval 'n kandidaat boeke, aantekeninge, memoranda of geskrifte in sy besit het, moet hy dit voor die aanvang van die eksamen aan die eksaminator oorhandig.

Skade aan boeke, instrumente, ens.

50. As 'n kandidaat 'n boek, dokument of instrument wat deur die eksaminator aan hom verskaf is, skend of andersins beskadig, moet hy die beskadigde boek, dokument of instrument vervang of andersins die skade herstel.

Uitgaan uit kamer.

51. 'n Kandidaat mag nie sonder toestemming van die eksaminator sy sitplek of die kamer verlaat nie. As hy die kamer verlaat, mag hy nie sonder toestemming van die eksaminator met die vraestel of opgaaf waarmee hy besig was, aangaan nie.

Alle werk moet vertoon word.

52. (1) 'n Kandidaat mag slegs op een kant van die antwoordboek werk of skryf en moet sy antwoorde duidelik en leesbaar skryf, en hy moet sy naam onderaan elke bladsy teken.

(2) 'n Kandidaat mag nie sy opgawes op skeurpapier uitwerk nie, of op vloecipapier wat vir sy gebruik by die eksamen verskaf is, skryf nie.

(3) Alle werk, uitgesonderd skets- en tekenwerk, moet met ink gedoen word.

(4) 'n Oortreding van die bepalings van hierdie regulasie kan die verlies van punte tot gevolg hê.

Straf vir afskryf, ens.

53. As 'n kandidaat 'n ongemagtigde boek of geskrif raadpleeg, of van 'n ander kandidaat afskryf of aan iemand anders hulp verleen of inligting verstrek, of tydens die eksamen enigerwyse met iemand in verbinding tree, of enige deel van die opgawes afskryf met die doel om dit uit die eksamenkamer te verwyder, word daar beskou dat hy in die eksamen gedruip het, en hy mag vir 'n tydperk van ses maande nie weer tot die aflê van 'n eksamen toegelaat word nie. 'n Kandidaat wat hom aan 'n tweede oortreding skuldig maak, mag nie voor na verloop van twaalf maande na sodanige tweede oortreding eksamen aflê nie. Die eksaminator moet van elke oortreding aan die Sekretaris verslag doen.

Kandidate kan eie metode volg.

54. Kandidate kan die verskillende opgawes volgens hul eie gebruiklike metode uitwerk, mits sodanige metode in beginsel korrek is. Duidelike uiteensettings, beredenering en berekening by die oplossing van opgawes sal paslike erkenning ontvang.

Straf vir oortreding van regulasies.

55. Ingeval 'n kandidaat enigeen van hierdie regulasies oortree, uitgesonderd 'n regulasie vir die oortreding waarvan 'n ander straf by hierdie regulasies bepaal word, of brutaal teenoor 'n eksaminator is, of homself wanordelik of onbehoorlik in of by 'n eksamenkamer gedra, kan die eksaminator hom afwys asof hy in die eksamen gedruip het, en as hy so afgewys word, mag hy vir 'n tydperk van drie maande nie toegelaat word om opnuut eksamen te doen nie.

Unauthorised Books and Papers Strictly Forbidden.

49. Candidates shall not have with them any books, notes, memoranda or papers other than those supplied for use at the examination. If any candidate has brought any books, notes, memoranda or papers with him, he shall hand them to the examiner before commencing the examination.

Damage to Books, Instruments, etc.

50. If a candidate defaces or otherwise damages any book, document or instrument supplied to him by the examiner, he shall replace the damaged book, document or instrument or otherwise make good the damage.

Leaving Room.

51. A candidate shall not, without the permission of the examiner, leave his seat or the examination room. If he leaves the room, he shall not without the consent of the examiner go on with any paper or problem on which he was engaged.

All Work to be Shown.

52. (1) A candidate shall work or write only on one side of the paper and shall write in a clear and legible hand and he shall sign his name at the foot of each page.

(2) A candidate shall not work out his problems on waste paper, nor write on the blotting paper supplied for his use in the examination.

(3) All work other than sketching and drawing shall be done in ink.

(4) A contravention of the provisions of this regulation may involve loss of marks.

Penalty for Copying, etc.

53. Any candidate who refers to any unauthorised book or paper, or copies from another or affords any assistance or gives any information to another, or communicates in any way with another during the time of examination, or copies any part of the problems for the purpose of taking them out of the examination rooms, shall be regarded as having failed the examination, and shall not be accepted for re-examination for a period of six months. A candidate guilty of a second offence shall not be allowed to be examined until twelve months have elapsed after such second offence. Each offence shall be reported to the Secretary by the examiner.

Candidates may use Own Method.

54. Candidates may work out the various problems according to any method they have been accustomed to use, provided such method is correct in principle. Suitable recognition will be given for clear statements, reasoning and calculation in solving the problems.

Penalty for Breach of Regulations.

55. If a candidate contravenes any of these regulations other than a regulation for the contravention of which another penalty is by these regulations prescribed, or is insolent to an examiner, or conducts himself in a disorderly or improper manner in or about the examination room, the examiner may treat him as having failed the examination, and if he is so treated he shall not be accepted for re-examination for a period of three months.

HOOFSTUK VI.

UITREIKING VAN SERTIFIKAAT.

Magtiging vir lewering van bekwaamheidsertifikate.

56. 'n Kandidaat wat in die eksamen slaag, ontvang van die eksaminator 'n vorm T.V. 5/106 soos in Bylae A uiteengesit, behoorlik voltooi, waarby die persoon aan wie dit geadresseer is, gemagtig word om die sertifikaat aan die kandidaat te lewer. 'n Kandidaat wat gedeeltelik in die eksamen geslaag of gedruip het, ontvang van die eksaminator 'n vorm T.V. 5/111, soos in Bylae A uiteengesit, behoorlik voltooi, wat die kandidaat moet behou en, wanneer hy weer eksamen kom aflê, aan die eksaminator moet toon.

Uitreiking van bekwaamheidsertifikaat as ingenieur-offisier.

57. As 'n kandidaat vir 'n bekwaamheidsertifikaat soos by hierdie regulasies voorgeskryf, die daarby vereiste ondervinding opgedoen en werkswinkel- en seediens verrig het en in die voorgeskrewe eksamen geslaag het, word die sertifikaat, behoudens die bepalinge van hierdie regulasies, aan hom uitgereik: Met dien verstande dat, ingeval die kandidaat, ingevolge hierdie regulasies, in besit moet wees van 'n bekwaamheid- of dienssertifikaat ten einde vir die aflê van die eksamen te kwalifiseer, hy laasgenoemde sertifikaat aan die eksaminator moet afgee.

(LET WEL.—Die aandag word gevestig op die voetnoot van regulasie 12.)

ENDOSSERING VAN SERTIFIKAAT AS TWEDE OF HOOF-INGENIEUROFFISIER.

58. (1) Die sertifikaat van 'n kandidaat word geëndosseer as hy bewys lewer dat hy die seediens verrig het soos voorgeskryf by regulasie 21 of 25, na gelang van die geval, en in die eksamen waarvan daarin melding gemaak word, geslaag het.

(2) Nieteenstaande die feit dat die houer van 'n sertifikaat wat hom die reg gee om as tweede ingenieur-offisier met stoomaandryf- en binnebrandaandryfmasjinerie op te tree, reg verkry het op die uitreiking aan hom van 'n bekwaamheidsertifikaat (stoom, of motor) as hoof-ingenieur-offisier, word laasgenoemde sertifikaat nie aan hom uitgereik nie tensy hy die sertifikaat wat deur hom gehou word, afgee, en na sodanige afgifte word die sertifikaat as hoof-ingenieur-offisier, behoudens die bepalinge van hierdie regulasies, aan hom uitgereik en geëndosseer met die strekking dat hy ook die reg het om as tweede ingenieur-offisier met stoomaandryf- of binnebrandaandryfmasjinerie, na gelang van die geval, op te tree.

(LET WEL.—Die aandag word gevestig op die voetnoot van regulasie 12.)

HOOFSTUK VII.

DIENSSERTIFIKAAT.

Hoe aansoek gedoen moet word.

59. 'n Applikant vir 'n dienssertifikaat ingevolge artikel tagtig van die Wet, moet die aansoekvorm T.V. 5/105, soos in Bylae A uiteengesit, voltooi, met vermelding van die nodige besonderhede, en dit by die bevoegde beampte indien of aan hom pos. Die bevoegde beampte stuur dan die aansoek aan die Sekretaris.

CHAPTER VI.

ISSUE OF CERTIFICATES.

Authority for Delivery of Certificates of Competency.

56. A candidate who passes the examination shall receive from the examiner a form T.V. 5/106 set forth in Annex A, duly completed, authorising the person to whom it is addressed to issue the certificate. A candidate who is partially successful or unsuccessful in the examination, shall receive from the examiner a form TV. 5/111 set forth in Annex A, duly completed, which must be retained and produced to the examiner when he next presents himself for examination.

Issue of certificate of Competency as Engineer-Officer.

57. If a candidate for a certificate of competency provided for by these regulations has gained the experience and performed the workshop and sea service required thereby and has passed the prescribed examination, the certificate shall, subject to the provisions of these regulations, be issued to him; Provided that if in terms of these regulations, it is necessary for the candidate to hold any certificate of competency or service in order that he may be qualified to sit for the examination, he shall surrender the last-mentioned certificate to the examiner.

(NOTE.—Attention is invited to the note appended to regulation 12.)

ENDORSEMENT OF CERTIFICATE AS SECOND OR CHIEF ENGINEER-OFFICER.

58. (1) If a candidate for an endorsement produces proof that he has performed the sea service prescribed by regulation 21 or 25, as the case may be, and has passed the examination referred to therein, his certificate shall be endorsed.

(2) Notwithstanding the fact that the holder of a certificate entitling him to act as Second Engineer-Officer on steam-driven and on motor propelling machinery has become entitled to the issue of a certificate of competency (steam or motor) as Chief Engineer-Officer, the last-mentioned certificate shall not be issued to him unless he surrenders the certificate held by him, and upon such surrender the certificate as Chief Engineer-Officer shall, subject to the provisions of these regulations, be issued to him and be endorsed to the effect that he is also entitled to act as Second Engineer-Officer on steam-driven or motor propelling machinery, as the case may be.

(NOTE.—Attention is invited to the Note appended to regulation 12.)

CHAPTER VII.

CERTIFICATE OF SERVICE.

How Application should be made.

59. An applicant for a certificate of service in terms of section eighty of the Act shall complete the form of application T.V. 5/105 set forth in Annex A, giving the necessary particulars, and shall hand or post it to the proper officer. The proper officer shall forward the application to the Secretary.

BYLAE A.

LYS VAN VORMS WAT IN HIERDIE REGULASIES VOORKOM.

Regulasie 6.....	Aansoek om geëksamineer te word vir 'n bekwaamheidsertifikaat as hoof- of tweede ingenieuroffisier, of vir 'n endossement van so 'n sertifikaat.....	T.V. 5/102.
Regulasie 13.....	Aansoek om 'n gesertifiseerde afskrif van 'n bekwaamheid- of bevoegdheidsertifikaat of dienssertifikaat.....	T.V. 5/103.
Regulasie 56.....	(a) Magtiging vir lewering van 'n bekwaamheidsertifikaat of bevoegdheidsertifikaat.....	T.V. 5/106.
	(b) Uitslae van eksamens.....	T.V. 5/111.
Regulasie 59.....	Aansoek om 'n dienssertifikaat.....	T.V. 5/105.

T.V. 5/102.

Volgnummer.....

UNIE VAN SUID-AFRIKA.

DEPARTEMENT VAN VERVOER—MARINE-AFDELING.
[Handelskeepvaartwet, 1951 (Wet No. 57 van 1951).]

AANSOEK OM GEËKSAMINEER TE WORD VIR 'N BEKWAAMHEIDCERTIFIKAAT AS.....

*(Meld hier graad van sertifikaat, ens. verlang.)

* Hierdie vorm word gebruik indien die sertifikaat wat verlang word een van die volgende is of waar die sertifikaat geëndosseer moet word:—

Hoof-ingenieuroffisier.
Tweede ingenieuroffisier.
Seemasjinis.
Assistent-seemasjinis.

A—Naam van applikant, ens.

Hawe.....

Voorname voluit (drukletters).	Familienaam (drukletters).	Permanente adres, met vermelding van stad, straat, huisnommer en naam van persoon by wie woonagtig (indien enige).

Geboortedatum.			Geboorteplek.	Nasionaliteit. (indien 'n burger as gevolg van registrasie of naturalisasie, moet dit hier gemeld en die nommer van die sertifikaat verstrek word.)
Dag.	Maand.	Jaar.	Stad en land.	

B—Besonderhede van alle vorige sertifikate, of in die Unie van Suid-Afrika of elders uitgereik. Indien geen, meld aldus dwarsoor hierdie afdeling.

No.	Stoom, Motor, Gekombineerde Stoom en Motor, Endossement, Assistent-seemasjinis (indien ander, spesifiseer).	Klas	Plek en datum van—		Indien te eniger tyd opgeskort of ingetrek, meld deur watter hof of gesag.	Datum.	Rede.
			Eksamen.	Uitreiking.			

C.—Sertifikaat tans verlang.

Stoom, Motor, Gekombineerde Stoom en Motor, Endossement, Deel A of Deel B, Seemasjinis of Assistent-seemasjinis.	Klas.	Hawe waar applikant eksamen wil aflê en datum.	Kantoor waarheen die sertifikaat gestuur moet word. (Nie slegs vir Deel A nie.)

ANNEX A.

LIST OF FORMS APPEARING IN THESE REGULATIONS.

Regulation 6.....	Application to be examined for a certificate of competency as Chief or Second Engineer-Officer, or an endorsement of such a certificate.....	T.V. 5/102.
Regulation 13.....	Application for certified copy of a certificate of competency or qualification or a certificate of service.....	T.V. 5/103.
Regulation 56.....	(a) Authority for delivery of a certificate of competency or qualification.....	T.V. 5/106.
	(b) Results of examination.....	T.V. 5/111.
Regulation 59.....	Application for a certificate of service.....	T.V. 5/105.

T.V. 5/102.

Rotation No.

UNION OF SOUTH AFRICA.

DEPARTMENT OF TRANSPORT—MARINE DIVISION.
[Merchant Shipping Act, 1951 (Act No. 57 of 1951.)]APPLICATION TO BE EXAMINED FOR A CERTIFICATE OF COMPETENCY AS.....
*(State here grade of certificate, etc., required.)

* This form is for use when the certificate required is one of the following or where a certificate requires an endorsement:—

Chief Engineer-Officer.
Second Engineer-Officer.
Marine Engineman.
Assistant Marine Engineman.

A.—Name of applicant, etc.

Port of

Christian Names in Full (Block Letters).	Surname (Block Letters).	Permanent Address, stating Town, Street, House Number and Name of Person (if any) with whom residing.

Date of Birth.			Place of Birth.	Nationality. (If a Citizen by Registration or Naturalization, this should be stated here and the number of the certificate given.)
Day.	Month.	Year.	Town and Country.	

B.—Particulars of all previous certificates whether issued in the Union of South Africa or elsewhere. If none, state so across this division.

No.	Steam, Motor, Combined Steam and Motor, Endorsement, Assistant Marine Engineman (if Other specify).	Class.	Place and Date of—		If at any time suspended or cancelled, state by what Court or Authority.	Date.	Cause.
			Examination.	Issue.			

C.—Certificate now required.

Steam, Motor, Combined Steam and Motor, Endorsement, Part A only, Part B only, Marine Engineman or Assistant Marine Engineman.	Class.	Port at which Applicant desires to be examined, and Date.	Office to which Certificate is to be sent. (Not for Part A only.)

UNIE VAN SUID-AFRIKA.

DEPARTEMENT VAN VERVOER—MARINE-AFDELING.
[Handelskeepvaartwet, 1951 (Wet No. 57 van 1951).]

AANSOEK OM 'N GESERTIFISEERDE AFSKRIF VAN 'N BEKWAAMHEID- OF BEVOEGDHEIDCERTIFIKAAT OF DIENSSERTIFIKAAT.

No. van verlore sertifikaat.

Graad van verlore sertifikaat.

Hawe van _____

AFDELING A.—NAAM, ENS., VAN APPLIKANT.

Naam. (1)	Adres. (2)

Geboortedatum. (3)	Geboorteplek. (4)

AFDELING B.—BESONDERHEDE VAN LAASTE DIENS.

Naam van laaste skip. (5)	Registrasiehawe en amptelike No. van laaste skip. (6)	Rang of gradering aan boord laaste skip. (7)	Beskrywing van laaste seereis.			
			Van. (8)	Na. (9)	Begin. (10)	Beëindig. (11)

BESONDERHEDE AANGAANDE VAARTUIE WAAROP APPLIKANT DIENS GEDOEN HET VOOR EN NA DIE UITREIKING AAN HOM VAN DIE SERTIFIKAAT WAT VERLORE IS.

Naam van skip. (12)	Registrasiehawe en amptelike No. (13)	Rang of gradering aan boord skip. (14)	Indien in vreemde of kushandel, of in die vissersbedryf. (15)	Diens.	
				Begin. (16)	Beëindig. (17)

AFDELING C.—BESTEMMING VAN SERTIFIKAAT.
(Moet deur die applikant voltooi word.)

Ek versoek dat die gesertifiseerde afskrif van my sertifikaat aan my afgelewer word by _____

_____ Handtekening van applikant.

AFDELING D.—VERKLARING WAT GEMAAK MOET WORD DEUR DIE APPLIKANT VOOR DIE BEVOEGDE BEAMPTTE.

Ek, _____ van _____

VERKLAAR HIERBY—

(1) dat my sertifikaat 'n sertifikaat was van* _____

as _____

en dat dit genommer was _____

(2) dat genoemde sertifikaat onder die volgende omstandighede verlore of vernietig is:—

† _____

(3) dat die verklaring wat hierin en in Afdelings A en B op die keersy hiervan gemaak is na my beste wete en oortuiging juis en waar is.

_____ Handtekening van applikant.

VERKLAAR VOOR MY TE _____

en die hernuwingsgelde van _____ kwitansie No. _____

ontvang die _____ dag van _____ 19 _____

_____ Handtekening en ampstitel van bevoegde beampte.

* Voeg in die woord Bekwaamheid, Bevoegdheid, of Diens en Graad.

† Meld hier die plek, datum en oorsaak van die verlies van die sertifikaat.

Die Sekretaris van Vervoer,
Pretoria.

T.V. 5/106. _____

No. _____

Naam van applikant _____

Volgnommer _____

Graad waarin geslaag _____

Magtiging aan bogemelde kandidaat verleen om sy *Bekwaamheidsertifikaat / Bevoegdheidsertifikaat van die Bevoegde

Beampte by die Hawe _____

te ontvang.

Datum _____

Eksaminator _____

* Skrap die woord wat nie van toepassing is nie.

UNIE VAN SUID-AFRIKA.

DEPARTEMENT VAN VERVOER—MARINE-AFDELING.
[Handelskeepvaartwet, 1951 (Wet No. 57 van 1951).]

MAGTIGING VIR AFLEWERING VAN 'N BEKWAAMHEIDCERTIFIKAAT OF BEVOEGDHEIDCERTIFIKAAT.

(L.W.—Hierdie magtiging is onderworpe aan die goedkeuring van die Sekretaris van Vervoer, Pretoria.)

Naam van applikant _____ Graad waarin geslaag _____

Lengte _____ Voet _____ Duim. Kleur van: Oë _____ Hare _____

Ras (Blanke, Kleurling, Naturel, Indiër: ander, spesifiseer) _____

_____ Handtekening van applikant.

Geliewe aan bogemelde persoon af te lewer die *Bekwaamheidsertifikaat/Bevoegdheidsertifikaat nadat hy die besonderhede wat daarin vereis word, voltooi het, en getuigskrifte of ander dokumente wat namens hom aan u deur die Sekretaris van Vervoer, Pretoria, deurgestuur is.

Hawe _____ Datum _____ 19 _____

Aan _____ Handtekening van eksaminator.

* Skrap die woord wat nie van toepassing is nie.

DIVISION C.—DESTINATION OF CERTIFICATE.
(To be completed by applicant.)

I request that the certified copy of my certificate may be delivered to me at _____

Signature of Applicant.

DIVISION D.—DECLARATION TO BE MADE BY APPLICANT BEFORE THE PROPER OFFICER.

I, _____ of _____

DO HEREBY DECLARE—

(1) that my certificate was a certificate of* _____
as _____

and that it was numbered _____

(2) that the said certificate was lost or destroyed under the following circumstances:—

† _____

(3) that the statements made herein and in Divisions A and B on the reverse side hereof are correct and true to the best of my knowledge and belief.

Signature of Applicant.

DECLARED BEFORE ME AT _____

and the renewal fee of _____ Receipt No. _____

received this _____ day of _____ 19 _____

Signature and Designation of Proper Officer.

* Insert the word Competency, Qualification or Service and Grade.
† Here state the place, date and cause of the loss of the certificate.

The Secretary for Transport,
Pretoria.

T.V. 5/106. _____

No. _____

Name of applicant _____

Rotation number _____

Grade for which passed _____

Authority given to the above
Candidate to obtain his *Certificate
of Competency/Qualification
from the Proper Officer at

the Port of _____

Date _____

Examiner _____

* Delete the word which does
not apply.

UNION OF SOUTH AFRICA.

T.V. 5/106.

DEPARTMENT OF TRANSPORT—MARINE DIVISION.
[Merchant Shipping Act, 1951 (Act No. 57 of 1951).]

**AUTHORITY FOR DELIVERY OF A CERTIFICATE OF COMPETENCY OR
QUALIFICATION.**

(N.B.—This authority is subject to the approval of the Secretary for Transport, Pretoria.)

Name of Applicant _____ Grade for which passed _____

Height _____ Feet _____ Inches. Colour of: Eyes _____ Hair _____

Race (European, Coloured, Native, Indian: other, specify) _____

Signature of Applicant.

Please deliver to the abovenamed person the Certificate of *Competency/Qualification when
he has completed the particulars required therein and testimonials or other documents forwarded
to you on his behalf by the Secretary for Transport, Pretoria.

Port _____ Date _____ 19 _____

To _____ Signature of Examiner.

* Delete the word which does not apply.

T.V. 5/111 _____

Hawe _____

Aanvangsdatum van eksamen en klas _____

Naam aan kandidaat _____

Kwal. seediens _____

Verwysing na korrespondensie (indien enige) _____

Eksamen. { Slegs Deel A,
(Skrap dié wat nie van Stoom,
toepassing is nie.) Motor,
Gekombineerde S. en M.
Endossement S. of M.

Deel A	Wiskunde *	
	Toegepaste meganika *	
	Hitte- en hitte-motore *	
	Tekene *	
Deel B	Elek. en skeepsontwerp *	
	Ing.-wese en mond. *	

Tydperk wat moet verstryk voor hereksaminering _____

Eksaminator se voorletters _____

T.V. 5/111 _____

UNIE VAN SUID-AFRIKA.

DEPARTEMENT VAN VERVOER—MARINE-AFDELING.
[Handelskeepvaartwet, 1951 (Wet No. 57 van 1951).]

EKSAMINERING VAN INGENIEUROFFISIERS.

UITSLAE VAN EKSAMENS.

* (Voeg in „Vrygestel”, „Geslaag”, „Gedruip”, of „Nie bereken nie”.)

Volgnommer _____

Naam van kandidaat _____

Verwysing na korrespondensie (indien enige) _____

Datum.	Hawe.	Klas.	Kwalifiserende† seediens wanneer eksamen afgele word.			Slegs Deel A, Stoom, Motor, Gekombineerde S. en M., Endossement (S. of M.).	Deel A.				Deel B.		Tydperk wat moet verstryk voor her- eksami- nering.	Eksaminator se voorletters.
							Wis-*	Toege-*	Hitte- en*	Tekene.*	Elektro-*	Ingenieurs-*		
			J.	M.	D.		kunde.	paste meganika.	hitte- motore.		tegniek en skeeps- boukunde.	wese en mondelings.		

Datumstempel.

Handtekening van kandidaat _____

Handtekening van eksaminator _____

L.W.—Hierdie vorm moet deur die kandidaat tesame met sy dokumente by die daaropvolgende eksamen vertoon word.

† Kwalifiserende seediens wat tot 'n applikant se voordeel vir Deel B van die eksamen staan (nadat daarvan gebruik gemaak is om 'n tekort in kwalifiserende werkswinkeldiens aan te vul).

T.V. 5/111

Port

Commencing date of examination and class

Name of candidate

Q.S. Service

Reference to correspondence (if any)

Examination.....
(Delete those not applicable.)

Part A only,
Steam,
Motor,
Combined S. and M.
Endorsement S. or M.

Part A	Mathematics *	
	Applied Mechanics *	
	H. and H.E.*	
	Drawing *	
Part B	E. and N.A.*	
	E.K. and Orals *	

Interval to elapse before re-examination

Initials of examiner

UNION OF SOUTH AFRICA.

DEPARTMENT OF TRANSPORT—MARINE DIVISION.
[Merchant Shipping Act, 1951 (Act No. 57 of 1951).]

EXAMINATION OF ENGINEER-OFFICERS.

RESULTS OF EXAMINATION.

*(Insert "Exempt", "Passed", "Failed", or "Not Assessed".)

Rotation No.

Name of Candidate

Reference to correspondence (if any)

Date.	Port.	Class.	Qualifying† Sea Service at Time of Examination.				Part A.				Part B.		Interval to elapse before Re-examination.	Examiner's Initials.
			Y.	M.	D.	Part A only, Steam, Motor, Combined S. and M., Endorsement (S. or M.).	Mathe-* matics.	Applied* Mech- anics.	Heat* and Heat Engines.	Drawing*.	Electrotech-* nology and Architecture.	Engineering* Knowledge and Orals.		

Office Stamp.

Signature of Candidate

Signature of Examiner

N.B.—This form must be produced by the candidate with his papers on subsequent examination.

† Qualifying sea service standing to applicant's credit for Part B of the examination (after any appropriation to compensate for a deficiency in qualifying workshop service).

UNIE VAN SUID-AFRIKA.

DEPARTEMENT VAN VERVOER—MARINE-AFDELING.
[Handelskeepvaartwet, 1951 (Wet No. 57 van 1951).]AANSOEK OM 'N DIENSSERTIFIKAAT KRAGTENS DIE BEPALINGS VAN ARTIKEL TAGTIG VAN DIE HANDELSKEEP-
VAARTWET, 1951 (WET NO. 57 VAN 1951).

Lees onderstaande opmerkings sorgvuldig:—

- (1) Artikel tagtig van die Handelskeepvaartwet 1951, is op bladsy 4 van hierdie vorm gedruk. Die artikel verskaf volledige inligting aangaande watter dienssertifikate toegeken kan word en aangaande die persone wat daarvoor aansoek kan doen.
- (2) (a) Persone wat in artikel tagtig (1) (a) genoem word, kan te eniger tyd aansoek om 'n dienssertifikaat kragtens hierdie Wet doen. Hulle word egter aangeraai om so gou doenlik aansoek te doen omdat hulle nie in sekere skepe in diens geneem kan word nie tensy hulle in besit is van 'n geldige dienssertifikaat wat kragtens Wet No. 57 van 1951 toegeken is. Hulle moet ook enige sertifikate wat deur hulle gehou word, afgee.
- (b) Persone wat in artikel tagtig (1) (b) genoem word, kan dienssertifikate kragtens hierdie Wet toegeken word mits hulle binne een jaar na die inwerkingtreding van die Wet aansoek doen en mits hulle die sertifikate wat deur hulle gehou word, afgee.
- (c) Persone wat in artikel tagtig (1) (c) genoem word, kan te eniger tyd aansoek om 'n dienssertifikaat kragtens die Wet doen.
- (3) Bewys van die vereiste seediens moet voorgelê en aan hierdie aansoek geheg word. Die bewys kan 'n ontslagsertifikaat, of 'n brief van 'n eienaar of ander verantwoordelike persoon wees.
- (4) Applikante vir dienssertifikate as gesagvoerder, navigasie-offisier, skipper, stuurman of bootsman moet slaag in kleur- en vormvisie-toetse, wat 'n oogtoets is. Hierdie is nie van toepassing op persone van wie in paragrawe (a) and (b) van Opmerking (2) hierbo melding gemaak word nie.
- (5) Van applikante vir dienssertifikate word vereis dat hulle op hierdie vorm 'n beëdigde verklaring moet doen. Indien 'n valse verklaring gedoen word, sal die applikant skuldig wees aan 'n misdryf en onderworpe wees aan 'n boete van £500.

A.—BESONDERHEDE VAN APPLIKANT.

Familienaam (in drukletters).	Voorname (in drukletters).	Geboortedatum.	Geboorteplek.	Nasionaliteit.	Adres.

Ek verlang 'n dienssertifikaat as _____
 en indien toegeken, moet dit aan die bevoegde beampte te _____ gestuur word vir uitreiking aan my.

B.—BESONDERHEDE VAN SEEDIENS.

Besonderhede van vaartuig.						Besonderhede van applikant se seediens.					Opmerkings.	
Naam van vaartuig.	Stoom, motor, ander.	Bruto-tonnemaat.	Perdekrag van masjiene.	Registrasiehoeven en amptelike No., of registrasienommer van vaartuig.	Waar in handel gedryf word (meld of vis-, kushandel, ander).	Hoedanigheid.	Vanaf.	Tot.	Diensttermyn.			
									Jare.	Maande.		Daar.
Totale seediens.....												
Dienstyd waarvoor bewys nou voorgelê is.....												
Dienstyd waarvoor geen bewys voorgelê is nie.....												

C.—VERKLARING WAT DEUR APPLIKANT GEDOEN MOET WORD.

Ek, die ondergetekende _____ verklaar hierby:—

- (1) dat die besonderhede wat in Afdelings A en B van hierdie vorm bevat is, na my beste wete en oortuiging juis en waar is;
 en
- (2) dat ek *(nie) 'n bekwaamheid- of dienssertifikaat het *(nie) *(wat ek nou afgee).

Handtekening van applikant.
 (Indien die applikant nie kan skryf nie, moet hy sy merk in die spasie hierbo, maak.)

Voor my verklaar te _____ op die _____ dag van _____ 19____

Handtekening en ampstitel van bevoegde beampte
 of kommissaris van ede.

* Skrap indien nie van toepassing nie.

UNION OF SOUTH AFRICA.

DEPARTMENT OF TRANSPORT—MARINE DIVISION.
[Merchant Shipping Act, 1951 (Act No. 57 of 1951).]

APPLICATION FOR A CERTIFICATE OF SERVICE UNDER THE PROVISIONS OF SECTION EIGHTY OF THE MERCHANT SHIPPING ACT, 1951 (ACT NO. 57 OF 1951).

Read the following notes carefully:—

- (1) Section eighty of the Merchant Shipping Act, 1951, is printed on page 4 of this form. The section provides full information as to what certificates of service may be granted and as to the persons who may apply for them.
- (2) (a) Persons who are mentioned under section eighty (1) (a) may apply at any time for a certificate of service under this Act. However, they are advised to apply as soon as possible since they may not be employed in certain ships unless they are in possession of a valid certificate of service granted under Act No. 57 of 1951. They must also surrender any certificates held by them.
- (b) Persons who are mentioned under section eighty (1) (b) may be granted certificates of service under this Act provided they make application within one year of the date of the coming into operation of the Act, and provided they surrender the certificates held by them.
- (c) Persons who are mentioned under section eighty (1) (c) may apply at any time for a certificate of service under the Act.
- (3) Evidence of the sea service required should be produced and attached to this application. The evidence may be a discharge certificate, or a letter from an owner or other responsible person.
- (4) Applicants for certificates of service as master, navigating officer, skipper, mate or boatswain must pass colour and form vision tests which is a test of eyesight. This does not apply to the persons referred to in paragraphs (a) and (b) of Note (2) above.
- (5) Applicants for certificates of service are required to make a sworn declaration on this application form. If a false statement is made the applicant will be guilty of an offence and liable to a fine of £500.

A.—PARTICULARS OF APPLICANT.

Surname (in Block Letters).	Christian Names (in Block Letters).	Date of Birth.	Place of Birth.	Nationality.	Address.

I desire a certificate of service as _____
and if granted, it should be forwarded to the proper officer at _____ for issue to me.

B.—PARTICULARS OF SEA SERVICE.

Particulars of Vessel.						Particulars of Applicant's Sea Service.						Remarks.
Name of Vessel.	Steam, Motor, Other.	Gross Tons.	Horse-power of Engines.	Port of Registry and Official No.: or Registration No. of Vessel.	Trade in which engaged (state whether Fishing, Coasting, other).	Capacity.	From.	To.	Length of Service.			
									Years.	Months.	Days.	
Total Sea Service.....												
Time served for which evidence is now produced.....												
Time served for which no evidence is produced.....												

C.—DECLARATION TO BE MADE BY APPLICANT.

I, the undersigned _____ hereby declare:—

- (1) that the particulars contained in Divisions A and B of this form are correct and true to the best of my knowledge and belief; and
- (2) that I have *(not) a certificate of competency or service *(which I now surrender).

Signature of Applicant.
(If applicant is unable to write, he should make his mark in the space above.)

Declared before me at _____ this _____ day of _____ 19____

Signature and Designation of Proper Officer or Commissioner of Oaths.

*Delete if not applicable.

D.—SERTIFIKAAT VAN EKSAMINATOR.

Datum en plek van kleur- en vorm- visie-toetse.		Uitslag.		Persoonlike beskrywing van kandidaat.					
				Lengte.		Kleur van—		Ras (meld of Blanke, Kleurling, Naturel, Indiër of ander).	Persoonlike merke of eienaardighede (indien enige).
Datum.	Plek.	Lettertoets.	Lanterntoets.	Voet.	Duim.	Oë.	Hare.		

Hierby sertifiseer ek dat die besonderhede bevat in Afdeling D na my beste wete en oortuiging juis is, en mynsinsiens mag 'n diens-
sertifikaat as _____ toegeken word.

Gedateer te _____ op die _____ dag van _____ 19 _____

Datumstempel.

Handtekening van eksaminator.

Aan die Sekretaris van Vervoer,
Pretoria.

E.—SLEGS VIR AMPTELIKE GEBRUIK.

Graad en nommer van sertifikaat uitgereik.	Datum en plek van uitreiking.	Vorige sertifikaat afgegee.

TOEKENNING VAN DIENSSERTIFIKATE.

Artikel tagtig van die Handelskeepvaartwet, 1951, lees:—

(1) Enige persoon wat—

- (a) onmiddellik voor die herroeping van die Koopvaardij (Certifikaten van Bekwaamheid) Wet, 1925 (Wet No. 45 van 1925), deur hierdie Wet, kragtens die voorbehoudsbepaling van subartikel (3) van artikel een van daardie Wet geregtig was om as gesagvoerder, stuurman of ingenieur op te tree; of
- (b) die houer is van 'n ongekanselleerde dienssertifikaat verleen kragtens artikel vyftien van genoemde Koopvaardij (Certifikaten van Bekwaamheid) Wet, 1925; of
- (c) te eniger tyd voor die inwerkingtreding van hierdie artikel ononderbroke vir minstens een jaar, of binne drie jaar voor gemelde inwerkingtreding vir twee of meer tydperke van altesame minstens een jaar—

- (i) as bootsman of as assistent tot die masjinië of masjienewerker van 'n vissersboot van eenhonderd of meer bruto-registerton wat in die Unie geregistreer is, opgetree het; of
 - (ii) as skeepskaptein, skipper, stuurman, maat, bootsman, masjinië of masjienewerker of as assistent tot die masjinië of masjienewerker van 'n kusvaarder of 'n vissersboot of robbe- of walvisvaarder van minder as eenhonderd bruto-registerton wat in die Unie geregistreer is, opgetree het,
- kan om 'n dienssertifikaat by die Sekretaris aansoek doen.

(2) Die Sekretaris kan aan die applikant—

- (a) as die aansoek kragtens paragraaf (a) van subartikel (1) gedoen word, 'n paslike dienssertifikaat toestaan wat hom magtig om as gesagvoerder, navigasie-offisier of ingenieuroffisier, al na die geval, van 'n skip van hoogstens eenduisend bruto-registerton (in die geval van 'n gesagvoerder of navigasie-offisier) of van hoogstens eenduisend aangegewe perdekrag (in die geval van 'n ingenieuroffisier) op te tree; of
- (b) as die aansoek kragtens paragraaf (b) van subartikel (1) gedoen word, 'n paslike dienssertifikaat toestaan wat hom magtig om as skipper, stuurman of seemasjinië, al na die geval, van 'n vissersboot op te tree; of
- (c) as die aansoek—

- (i) kragtens paragraaf (c) (i) van subartikel (1) gedoen word, 'n paslike dienssertifikaat toestaan wat hom magtig om as bootsman of as assistent-seemasjinië, al na die geval, van 'n vissersboot op te tree; of
- (ii) kragtens paragraaf (c) (ii) van subartikel (1) gedoen word, 'n paslike dienssertifikaat toestaan wat hom magtig om op te tree as skipper, maat, ingenieuroffisier of assistent-seemasjinië, al na die geval, van 'n kusvaarder of 'n vissersboot of robbe- of walvisvaarder, al na die geval, van minder as eenhonderd bruto-registerton, en die hoedanigheid waarin hy aldus gemagtig word om op te tree mag nie hoër wees nie as die laagste hoedanigheid waarin hy opgetree het gedurende die tydperk of tydperke ten aansien waarvan sy eis gegrond is.

(3) Voordat 'n dienssertifikaat toegeken word, word daar aan die Sekretaris afgegee—

- (a) as die aansoek gedoen word kragtens paragraaf (a) van subartikel (1) en uit hoofde van die besit van 'n sertifikaat bedoel in die in daardie paragraaf vermelde voorbehoudsbepaling, daardie sertifikaat; of
- (b) as die aansoek gedoen word kragtens paragraaf (b) van subartikel (1), die sertifikaat op die besit waarvan die aansoek gegrond is.

(4) In geval van 'n aansoek kragtens paragraaf (c) van subartikel (1) kan die toekenning van 'n dienssertifikaat agterweë gehou word totdat die applikant in die voorgeskrewe gesigstoetse vir kleur en vorm geslaag het.

(5) Subartikels (1) en (2) is van toepassing op dié in paragraaf (b) van subartikel (1) bedoelde dienssertifikate gedurende die tydperk van een jaar na die inwerkingtreding van hierdie artikel en niks langer nie.

(6) 'n Dienssertifikaat wat kragtens hierdie artikel toegeken is, word vir die doeleindes van hierdie Wet en in die mate in sodanige dienssertifikaat aangedui, as 'n bekwaamheidsertifikaat beskou.

D.—CERTIFICATE OF EXAMINER.

Date and Place of Colour and Form Vision Tests.		Result.		Personal Description of Candidate.					
				Height.		Colour of—		Race (state whether European, Coloured, Native, Indian or Other.)	Personal Marks or Peculiarities (if any).
Date.	Place.	Letter Test.	Lantern Test.	Feet.	Inches.	Eyes.	Hair.		

I hereby certify that the particulars contained in Division D are to the best of my knowledge and belief correct, and in my opinion a certificate of service as _____ should be issued.

Dated at _____ this _____ day of _____ 19____

Date Stamp.

To the Secretary for Transport,
Pretoria.

Signature of Examiner.

E.—FOR OFFICIAL USE ONLY.

Grade and No. of Certificate issued.	Date and Place of Issue.	Previous Certificates surrendered.

GRANTING OF CERTIFICATES OF SERVICE.

Section eighty of the Merchant Shipping Act, 1951, reads:—

(1) Any person who—

- (a) immediately before the repeal by this Act of the Merchant Shipping (Certificates of Competency) Act, 1925 (Act No. 45 of 1925); was entitled in terms of the proviso to sub-section (3) of section one of that Act, to act as master, mate or engineer; or
- (b) is the holder of an uncancelled certificate of service granted under section fifteen of the said Merchant Shipping (Certificates of Competency) Act, 1925; or
- (c) at any time before the coming into operation of this section has for a continuous period of not less than one year, or within three years before the said coming into operation has for two or more periods amounting in the aggregate to not less than one year—
 - (i) acted as boatswain or as assistant to the engineer or driver of a fishing boat of one hundred or more gross register tons registered in the Union; or
 - (ii) acted as master, skipper, mate, second hand, engineer or driver or as assistant to the engineer or driver of a coasting ship or a fishing, sealing or whaling boat of less than one hundred gross register tons registered in the Union, may apply to the Secretary for a certificate of service.

(2) The Secretary may grant to the applicant—

- (a) if the application is made under paragraph (a) of sub-section (1), an appropriate certificate of service authorising him to act as master, navigating officer or engineer-officer, as the case may be, of a ship of not more than one thousand gross register tons (in the case of a master or navigating officer) or of not more than one thousand indicated horse-power (in the case of an engineer-officer); or
- (b) if the application is made under paragraph (b) of sub-section (1), an appropriate certificate of service authorising him to act as skipper, mate or marine engineman, as the case may be, of a fishing boat; or
- (c) if the application is made—
 - (i) under paragraph (c) (i) of sub-section (1), an appropriate certificate of service authorising him to act as boatswain or assistant marine engineman, as the case may be, of a fishing boat; or
 - (ii) under paragraph (c) (ii) of sub-section (1), an appropriate certificate of service authorising him to act as skipper, mate, engineer-officer or assistant marine engineman, as the case may be, of a coasting ship or a fishing, sealing or whaling boat, as the case may be, of less than one hundred gross register tons, and the capacity in which he is so authorised to act shall not be higher than the lowest capacity in which he acted during the period or periods in respect of which his claim is based.

(3) Before a certificate of service is granted there shall be surrendered to the Secretary—

- (a) if the application is made under paragraph (a) of sub-section (1), and by virtue of the possession of such a certificate as is referred to in the proviso mentioned in that paragraph, that certificate; or
- (b) if the application is made under paragraph (b) of sub-section (1), the certificate upon the possession of which the application is based.

(4) In the case of an application under paragraph (c) of sub-section (1), the grant of a certificate of service may be withheld until the applicant has passed the colour and form vision tests prescribed.

(5) Sub-sections (1) and (2) shall apply in respect of certificates of service referred to in paragraph (b) of sub-section (1) during the period of one year after the coming into operation of this section and no longer.

(6) A certificate of service granted in terms of this section shall, for the purposes of this Act, and to the extent indicated in such certificate of service, be deemed to be a certificate of competency.

BYLAE B.

(1) VOORBEELD VAN GETUIGSKRIFVORM VIR WERKSWINKELDIENS.

Naam en adres van ingenieurswerk:

Hiermee getuig ek dat onderstaande 'n volledige en juiste opgaaf is van die werkswinkeldiens wat deur
 onder my toesig by bostaande onderneming verrig is.

Tydperk van diens. Datums.		Totale tydperk.	Aard van pligte. (Vir toepaslike beskrywing kyk hieronder.)	Besonderhede van verlof tot afwesigheid wat weekliks toe- gestaan is ten einde applikant in staat te stel om tegniese studies te onderneem.
Van.	Tot.			

Verslag oor bekwaamheid

Verslag oor gedrag

Opmerkings (indien enige)

Handtekening van werkgewer of van sy verteenwoordiger

BESKRYWING VAN PLIGTE

- I. Monteer- en/of oprigting by die vervaardiging en/of instandhouding van soliede masjinerie (bv. masjinerie met hoofas wat meer as ses duim in deursnee is).
 - II. Monteerwerk, uitgesonderd die monteer van soliede masjinerie.
 - III. Metaaldraai (goeie swaar werk).
 - IV. Masjienwerk (uitgesonderd by die draaibank).
 - V. Werk in tekenaarskantoor, as tekenaar of ingenieur.
 - VI. Ander werk, waarvan die aard gespesifiseer moet word.
- Die gebruik van die toepaslike telwoorde is voldoende behalwe in die geval van VI.

(2) VOORBEELD VAN GETUIGSKRIFVORM VIR SEEDIENS.

Naam en adres van eienaar van skip of redery

Hiermee sertifiseer ek dat onderstaande 'n volledige en juiste opgaaf is van die seediens wat in
 onder my toesig aan boord van die* verrig het.

Tydperk van diens. Datums.		Rang van offisier en werklike voorrang tydens waghoudiens.	Soort hoofmasjiene en ketels. Enkel- of dubbelskroef.	Aard van pligte. (Vir toepaslike beskrywing kyk hieronder.)
Van.	Tot.			

Verslag oor bekwaamheid

Verslag oor gedrag

Verslag oor soberheid

Handtekening van hoofingenieur

Opmerkings (indien enige)

Handtekening van { Ingenieur-superintendent
 of
 Gesagvoerder of ander verteenwoordiger van eienaars

BESKRYWING VAN PLIGTE.

- I. Met monteerwerk, lietsy bedags of op gereelde waghoudings:—
 - (a) In die hoofmasjiene- en ketelruim.
 - (b) Buitekant die hoofmasjiene- en ketelruim.
- II. (a) By verkoelings- of ander masjinerie wat nie noodsaaklik is vir die aandryf van die vaartuig nie.
 (b) By hulpmasjiene wat afsonderlik is van die hoof-aandryfeenhede maar wat daarmee saam werk.
- III. Op gereelde waghoudings by hoofmasjiene as:—
 - (a) eerste masjienkamer-assistent onder die senior beampste wat in volle bevel is.
 - (b) tweede masjienkamer-assistent.
 - (c) junior masjienkamer-assistent.
- IV. Op gereelde waghoudings by hoofketels:—
 - (a) In bevel van alle stookplekke.
 - (b) In bevel van 'n gedeelte van of van slegs een stookplek.
 - (c) As ketelkamer-assistent.
- V. Op gereelde waghoudings by hoofmasjiene en ketels tegelykertyd:—
 - (a) In volle bevel van die hele wag.
 - (b) As eerste assistent van die senior beampste wat in volle bevel is.
 - (c) As junior assistent.

OPMERKING.—Daar word aanbeveel dat hierdie vorm gebruik moet word wanneer die ingenieur oor wie verslag gedoen word, of die hoofingenieur, die skip verlaat.

* Meld die naam van die skip, amptelike nommer, en of dit 'n stoom- of motorskip is.

ANNEX. B.

(1) SPECIMEN FORM OF TESTIMONIAL FOR WORKSHOP SERVICE.

Name and address of Engineering Works _____

I certify that the following is a full and true statement of the workshop service performed by _____
under my supervision at the above works.

Period of Service. Dates.		Total Period.	Nature of Duties. (For appropriate description see below.)	Particulars of Weekly Release Periods to permit Apprentice to pursue Technical Studies.
From.	To.			

Report as to ability _____

Report as to conduct _____

Remarks (if any) _____

Signature of employer or his representative _____

DESCRIPTION OF DUTIES.

- I. Fitting and/or erecting in the manufacture and/or maintenance of substantial machinery (e.g. machinery with main shaft exceeding six inches in diameter).
- II. Fitting other than on substantial machinery.
- III. Metal turning (good heavy work).
- IV. Machine work (other than lathe).
- V. Work in Drawing Office, as draughtsman or engineer.
- VI. Other work, the nature of which should be specified.
- The use of the appropriate numerals is sufficient except in case VI.

(2) SPECIMEN FORM OF TESTIMONIAL FOR SEA SERVICE.

Name and address of Shipowner or Company _____

I certify that the following is a full and true statement of the sea service performed by Mr. _____
under my supervision on board the* _____

Period of Service. Dates.		Rank of Officer and actual Seniority on Watch.	Type of Main Engines and Boilers. Single or Twin-screw.	Nature of Duties. (For appropriate description see below.)
From.	To.			

Report as to ability _____

Report as to conduct _____

Report as to sobriety _____

Signature of Chief Engineer _____

Remarks (if any) _____

Signature of { Engineer Superintendent _____

or

Master or other Representative of Owners _____

DESCRIPTION OF DUTIES.

- I. On fitters' work either by day or regular watch:—
- (a) Within main engine and boiler spaces.
- (b) Outside main engine and boiler spaces.
- II. (a) On refrigerating or other machinery not essential to the propulsion of the vessel.
- (b) On auxiliary engines separated from main propelling units but worked in conjunction therewith.
- III. On regular watch on main engines as:—
- (a) First Engine Room Assistant under the Senior in full charge.
- (b) Second Engine Room Assistant.
- (c) Junior Engine Room Assistant.
- IV. On regular watch on main boilers:—
- (a) In charge of all stokeholds.
- (b) In charge of a section or one stokehold only.
- (c) As Boiler Room Assistant.
- V. On regular watch on main engines and boilers simultaneously:—
- (a) In full charge of the entire watch.
- (b) As First Assistant to the Senior in full charge.
- (c) As Junior Assistant.

NOTE.—It is recommended that this form should be used when the Engineer reported on, or when the Chief Engineer, leaves a ship.

* State name of ship, official number, and whether steam or motor ship.

BYLAE C.

LEERPLANNE VIR DIE EKSAMENS VAN HOOF- EN TWEEDE INGENIEUROFFISIER.

(LET WEL.—KENNIS VAN TALE.)

Vanweë die wederkerige ooreenkoms waarkragtens Suid-Afrikaanse bekwaamheidsertifikate vir die grade in paragrawe (k) en (l) van subartikel (1) van artikel vyf-en-sewentig van die Wet uiteengesit, nl. hoof- en tweede ingenieursoffisier, aanvaar word as kwalifikasies vir diens op Statebondskepe, moet elke kandidaat die eksaminator tevrede stel dat hy die Engelse taal goed genoeg kan praat en skryf om die pligte wat van hom aan boord vereis word, uit te voer.)

VAKKE WAARVAN 'N BASIESE KENNIS VEREIS WORD.

DEEL A.

OPMERKINGS.

(1) Die probleme sal miskien kennis van die sentimeter-gram-sekondestelsel (S.G.S.) en meter-kilogram-sekondestelsel (M.K.S.) vereis, maar hulle sal van so 'n aard wees dat hulle met 'n kennis van elementêre algebra, meetkunde en plat driehoeksmeting opgelos sal kan word.

(2) Kennis van die gebruik van logaritmes sal vereis word.

(3) Formules met betrekking tot die hoër wiskunde of konstantes wat nodig is vir die oplossing van enige probleem, sal verstrekkend word.

(4) Grafiese oplossings sal aangenêem word wanneer daar nie uitdruklik om 'n analitiese oplossing gevra word nie.

(5) Kandidate kan, as hulle wil, van die skuifliniaal by hul berekenings gebruik maak, maar moet in iedere geval die trappe wat tot die berekenings gevoer het, volledig opgee.

TWEEDE INGENIEUROFFISIER—WISKUNDE.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Rekenkunde.—Herleiding van fisiese hoeveelhede, waarby lengte, oppervlakte, volume of krag betrokke is, van een eenheidstelsel na 'n ander. Verhouding en eweredigheid. Persentasies.

Algebra.—Indekse, insluitende breukvormige en negatiewe tipes. Die gebruik van gewone logaritmes vir vermenigvuldiging, verdeling, magte en magswortels. Die gebruik van Neperse logaritmes. Die vereenvoudiging van algebraïese uitdrukkings. Die optel, aftrek, vermenigvuldiging en verdeling van algebraïese funksies. Herrangskikking van formules. Splittings in faktore. Algebraïese breuke. Kwadrate en kubusse van veeltermen, soos $(a \pm b)^2$ en $(a \pm b)^3$. Eenvoudige vergelykings. Kwadratiese vergelykings en oplossing deur splitsing in faktore of deur kwadraatvoltooiing. Bewys van algemene formule vir oplossing. Gelyktydige vergelykings, of twee liniêre vergelykings of een liniêre en een kwadratiese vergelyking. Variasie, reg en omgekeerd.

Grafiekwerk.—Eenvoudige grafieke van statistieke. Die grafiek $y = ax + b$ of vanaf berekende waardes of vanaf eksperimentele resultate. Berekening van konstante vanaf grafiek. Grafiese oplossing van eenvoudige gelyktydige vergelykings waarby twee onbekendes betrokke is. Die grafiek van $y = ax^2 + bx + c$ en grafiese oplossing van die vergelyking $ax^2 + bx + c = 0$.

Driehoeksmeting.—Afmeting van hoeke in grade en straalhoeke. Komplementêre en supplementêre hoeke. Sinus, kosinus en tangens van hoeke tot 360° . Oplossing van reghoekige driehoeke. Bewys van die sinus- en kosinus-reëls. Oplossing van driehoeke met toepassing van hierdie reëls. Oplossing van eenvoudige trigonometriese vergelykings. Ontwikkeling van $\sin(A \pm B)$ en $\cos(A \pm B)$.

Meetkunde.—Eienskappe van driehoeke. Opsombaarheid van die hoeke. Verhouding tussen buitehoeke en binnehoeke. Gelykbenige en gelyktydige driehoeke. Gelykvormige en kongruente driehoeke. Die sirkel. Eienskappe van koorde en raaklyne. Hoeke in dieselfde segment. Middelpunthoeke en omtrekshoeke.

Oppervlakte- en volumeberekening.—Oppervlakte van driehoek, veelhoek, parallelogram, trapesium, sirkel, sektor en segment van 'n sirkel en ellips. Oppervlakte van skewe deursnee van reëlmatige liggame met gelyknamige deursnee. Oppervlakte en gemiddelde hoogte volgens middelordinaatreël en volgens die eerste reël van Simpson. Oppervlakteverhouding van gelykvormige figure. Volumes en buite-oppervlakte van oppervlakte van prisma's, piramides, afgeknotte kegels, sfere, silinders en kegels. Volumeverhouding van gelykvormige liggame. Omwentelingsliggame.

TWEEDE INGENIEUROFFISIER—TOEGEPASTE MEGANIKA.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Algemeen.—Toepassings van oppervlakte en volumes op probleme soos die gewig van 'n masjien se bestanddele. Soortlike gewig. Die eerste reël van Simpson soos toegepas op oppervlakte en volumes.

Statika.—Krag. Swaartekragenhede. Krag as 'n vektor. Kragdriehoek en -veelhoek. Resulterende krag en ewilibrant van 'n stelsel van inmekaarlopende, saamvakkige kragte. Ewewig van drie kragte in dieselfde vlak. Moment van 'n krag. Koppels. Momente van oppervlakte en volumes. Sentroides en swaartepunte (beperk tot meetkundige vorms). Ewewigstoestande van vaste liggame. Hellende vlak. Nodige krag wat parallel met die vlak toegepas word om 'n liggaam teen die vlak op of af te trek of dit stasionêr te hou (insluitende wrywingseffek). Werk verrig teen gelykmatige snelheid teen die vlak op.

Wrywing.—Wrywingswette vir droë oppervlakte. Wrywingskoëffisiënt. Wrywingshoek. Energie en krag wat verlore gaan as gevolg van die wrywing in enkelvoudige koeëlaars.

Kinematika.—Liniêre beweging. Grafieke en vergelykings vir verplasing, spoed, snelheid en gelykmatige versnelling. Eenvoudige gevalle van vektor-snelheidsverandering en die versnelling wat teweeggebring word. Betrekklike snelhede in een vlak alleen. Hoekbeweging. Vergelykings vir verplasing, snelheid en gelykmatige versnelling.

Dinamika.—Werk en krag. Perdekrag. Probleme met konstante krag of krag met liniêre variasie. Energie. Behoud van arbeidsvermoë. Potensiële energie. Kinetiese energie van transformasie. Die wette van beweging van Newton. Bewegingshoeveelheid en die veranderingstempo van bewegingshoeveelheid. Middelpuntvliedende krag en die toepassing daarvan op sentrifugaal-reguleurs, onbelaste reguleurs, ronde leibane en masjienonderdele. Spanning in dun vellings as gevolg van middelpuntvliedende werking.

Masjiene.—Eenvoudige hysmasjinerie. Grafieke van draagvermoë en belastingsrendement. Liniêre wet. Snelheidsverhouding, meganiese voordeel en rendement van die volgende masjiene: windasmasjinerie, differensiaal-windasmasjinerie, touskyftakel, differensiaal-takel, domkrag, Warwick-skroef, waterdrukdomkrag, skroefkettingsblokke en enkel- en dubbelhefboom-kaapstanders. Reduksiedryfwerk.

Spanning en vervorming.—Direkte spanning en vervorming. Skuifspanning. Die wet van Hooke. Elastisiteitsmodulus. Treksparingsgrens. Elastisiteitsgrens. Eweredigheidsgrens. Persentasie vormverandering en vermindering van oppervlakte. Arbeidspanning. Sekerheidskoëffisiënt. Spanning as gevolg van beperkte uitsetting of sametrekking van enkelvoudige onderdele.

Balke.—Vrydraers en enkelvoudig gesteunde balke met punt- of gelykmatig verdeelde belastings. Skuifkrag- en buigmomentdiagramme. Spanning as gevolg van buiging, met die fundamentele buigvergeliking en die tweede moment van oppervlakte van die deursnee aangegee.

Wringing.—Draaimoment as gevolg van krukmeganisme van masjiene. Sterkte en styfheid van soliede of hol dryfasse met ronde deursnit, met die fundamentele torsie vergelyking en die polêre tweede moment van oppervlakte aangegee. Kragoorebrenging deur dryfasse. Koppelbout.

Dun huide.—Spanning op die omtrek en in die lengte van dun silindriese en bolvormige huide onderworpe aan inwendige druk.

Lasse.—Sterkte van die volgende lasse: enkele, dubbele en driedubbele klinklap- en stuiklasse en stuikswaaislasse.

Hidrostatika.—Die beginsel van Archimedes. Ewewig van drywende liggame. Soortlike gewig. Vloeistofmeter van konstante gewig. Variasie van vloeistofdruk met diepte. Totale krag as gevolg van vloeistofdruk op ingedompelde oppervlakte van vlakke, horisontaal of vertikaal. Drukpunt op die oppervlakte van 'n reghoekige vertikale vlak of 'n driehoekige vlak se oppervlakte, albei met een hoek parallel met die oppervlakte van die vloeistof.

Hidroulika.—Voluit stroming van vloeistof deur pype onder konstante drukhoogte van water. Stroming deur opening. Koëffisiënt van snelheid, sametrekking van oppervlakte en uitstroming.

ANNEX. C.

SYLLABUSES FOR THE EXAMINATIONS OF CHIEF AND SECOND ENGINEER-OFFICERS.

(NOTE.—KNOWLEDGE OF LANGUAGES.)

Because of the reciprocal arrangements under which South African certificates of competency for the grades set forth in paragraphs (k) and (l) of sub-section (1) of section seventy-five of the Act, viz., Chief and Second Engineer-Officers are accepted as qualifications for service in Commonwealth ships, every candidate shall satisfy the examiner that he is able to speak and write the English language sufficiently well to perform the duties required of him on board ship.

FUNDAMENTAL KNOWLEDGE SUBJECTS.

PART A.

NOTES.

- (1) The problems may require a knowledge of the C.G.S. and M.K.S. systems, but will be such as can be solved by the knowledge of elementary algebra, geometry and plane trigonometry.
- (2) A knowledge of the use of logarithms will be required.
- (3) Formulae involving higher mathematics or constants required for the solution of any problem will be given.
- (4) Graphical solutions will be acceptable where the analytical solution is not expressly stated to be required.
- (5) Candidates may, if they wish, use slide rules for their calculations, but in each case a full statement of the steps leading to the calculations must be shown.

SECOND ENGINEER-OFFICER—MATHEMATICS.

(One paper of three hours. Six questions only out of nine to be attempted.)

Arithmetic.—Conversion of physical quantities involving length, area, volume or force from one system of units to another. Ratio and proportion. Percentages.

Algebra.—Indices, including fractional and negative types. Use of common logarithms for multiplication, division, powers and roots. Use of Napierian logarithms. Simplification of algebraic expressions. Addition, subtraction, multiplication and division of algebraic functions. Re-arrangement of formulae. Factorisation. Algebraic fractions. Squares and cubes of polynomials such as $(a \pm b)^2$ and $(a \pm b)^3$. Simple equations. Quadratic equations and solution by factorisation or by completing the square. Proof of general formula for solution. Simultaneous equations, either two linear equations or one linear and one quadratic. Variation, direct and inverse.

Graphical Work.—Simple graphs of statistics. The graph $y = ax + b$ either from calculated values or from experimental results. Calculation of constants from graph. Graphical solution of simple simultaneous equations involving two unknowns. Graph of $y = ax^2 + bx + c$ and graphical solution of equation $ax^2 + bx + c = 0$.

Trigonometry.—Measurement of angles in degrees and radians. Complementary and supplementary angles. Sine, cosine and tangent of angles up to 360° . Solution of right-angled triangles. Proof of sine and cosine rules. Solution of triangles by these rules. Solution of simple trigonometric equations. Expansion of $\sin(A \pm B)$ and $\cos(A \pm B)$.

Geometry.—Properties of triangles. Sum of the angles. Relation between exterior and interior angles. Isosceles and equilateral triangles. Similar and congruent triangles. The circle. Properties of chords and tangents. Angles in the same segment. Angles at centre and circumference.

Mensuration.—Areas of triangle, polygon, parallelogram, trapezium, circle, sector and segment of a circle and ellipse. Areas of oblique sections of regular solids of uniform cross-section. Area and mean height by mid-ordinate rule and by Simpson's first rule. Ratio of areas of similar figures. Volumes and surface areas of prisms, pyramids, frustums, spheres, cylinders and cones. Ratio of volumes of similar solids. Solids of revolution.

SECOND ENGINEER-OFFICER—APPLIED MECHANICS.

(One paper of three hours. Six questions only out of nine to be attempted.)

General.—Applications of areas and volumes to problems such as the weight of engine components. Specific gravity. Simpson's first rule as applied to areas and volumes.

Statics.—Force. Gravitational units. Force as a vector. Triangle and polygon of forces. Resultant and equilibrant of a system of concurrent co-planar forces. Equilibrium of three co-planar forces. Moment of a force. Couples. Moments of areas and volumes. Centroids and centres of gravity (limited to geometrical shapes). Conditions of equilibrium of solids. Inclined plane. Necessary force applied parallel to the plane to pull body up or down the plane or to hold it stationary (including effect of friction). Work done at uniform speed up the plane.

Friction.—Laws of friction for dry surfaces. Coefficient of friction. Friction angle. Energy and power lost due to friction in simple bearings.

Kinematics.—Linear motion. Graphs and equations for displacement, speed, velocity and uniform acceleration. Simple cases of vector change of velocity and the acceleration produced. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration.

Dynamics.—Work and power. Horse-power. Problems with constant force or force with linear variation. Energy. Conservation of energy. Potential energy. Kinetic energy of translation. Newton's laws of motion. Momentum and rate of change of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action.

Machines.—Simple lifting machine. Graphs of load-effort and load-efficiency. Linear law. Velocity ratio, mechanical advantage and efficiency of the following machines: wheel and axle, differential wheel and axle, rope pulley blocks, differential pulley blocks, screw jack, Warwick screw, hydraulic jack, worm-driven chain blocks and single and double purchase crab winches. Reduction gearing.

Stress and Strain.—Direct stress and strain. Shear stress. Hooke's law. Modulus of elasticity. Ultimate tensile stress. Yield stress. Limit of proportionality. Percentage elongation and reduction of area. Working stress. Factor of safety. Stress due to restricted expansion or contraction of single members.

Beams.—Cantilevers and simply supported beams with concentrated or uniformly distributed loads. Shearing force and bending moment diagrams. Stress due to bending, given the fundamental bending equation and the second moment of area of the section.

Torsion.—Twisting moment due to engine crank mechanism. Strength and stiffness of solid or hollow shafts of circular cross-section given the fundamental torsion equation and the polar second moment of area. Power transmitted by shafts. Coupling bolts.

Thin Shells.—Circumferential and longitudinal stress in thin cylindrical and spherical shells subject to internal pressure.

Joints.—Strength of the following joints: Single, double and treble riveted lap and butt joints and butt welded joints.

Hydrostatics.—Archimedes' principle. Equilibrium of floating bodies. Specific gravity. Constant weight hydrometer. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces, horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid.

Hydraulics.—Full bore flow of liquid through pipes under constant head. Flow through orifice. Coefficients of velocity, contraction of area and discharge.

HOOF-INGENIEUROFFISIER—TOEGEPASTE MEGANIKA.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Statika.—Die ewewigswette. Momente en koppels. Kragteveelhoek. Rapsonskuif.*Wrywing.*—Die wet van droë wrywing. Wrywingshoek. Wrywingskoppelings. Wrywing op hellende vlak. Wrywing op drade. Werk wat teen wrywing verrig word.*Kinematika.*—Beweging in die lengterigting en hoekbeweging met gelykmatige versnelling. Versnelling as gevolg van swaartekrag. Snelheid-tempografieke.*Betreklike snelheid en versnelling.*—Uitwerking van 'n stroming op die snelheid en koers van 'n skip. Betreklike snelheid tussen liggame wat in verskillende vlakke beweeg.*Dinamika.*—Die wet van beweging van Newton. Die kragvergelyking. Die Atwood-masjien. Versnelling van verbinde liggame. Die uitwerking van eenvoudige lugweerstand op beweging onder die invloed van swaartekrag. Die momentkoppelvergelyking. Die behoud van hoeveelheidsbeweging. Kinetiese energie van transformasie en van rotasie. Vliegwiele. Potensiële energie. Behoud van energie. Stootkragte. Middeelpuntvliedende krag. Reguleur van Porter met suierwrywing. Enkelvoudige harmoniese beweging. Enkelvoudige of matematisie slinger. Eenvoudige trillings. Dinamiese balansering van massas wat in een vlak draai. Basiese dinamika van die masjienmeganisme. Gebruik van suiersnelheid- en -versnellingsformules. Afleiding van suierverplasingsformule.*Masjiene.*—Snelheidsverhouding. Meganiese voordeel. Rendement.*Spanning en vervorming.*—Direkte spanning en vervorming en elastisiteitsmodulus. Skuifspanning en -vervorming en glydingsmodulus. Spannings op hellende vlakke. Sterkte van enkelvoudige verbindings soos sluitwig- of skroeflase. Vormveranderingsvermoë as gevolg van direkte spanning. Skielike belastings.*Saamgestelde stawe.*—Uitwerking van direkte belasting en van temperatuurveranderinge.*Balke.*—Skuifkrag- en buigmomentdiagramme vir vrydraers en enkelvoudig gesteunde balke. Spannings in balke met enkelvoudige deursnit. Gebruik van eenvoudige afwykingsformules.*Wringing.*—Wringingsvergelykings vir soliede en hol dryfasse met ronde deursnit. Wringing van dryfas met voering toegerus. Perdekrag oorgebring. Spiraalvere met digte spiraal.*Stutte.*—Uitmiddelpuntige belasting van kort kolomme. Gebruik van stutformules.*Dun huide.*—Spannings in dun huide. Ontwerp van klinknate. Gebruik van ketelrompontwerpformules.*Hidrostatika.*—Indompeling in twee vloeistowwe van verskillende soortlike gewig. Totale krag en drukpunt op ingedompelde oppervlakte soos tenks en beskotte.*Hidroulika.*—Bernoulli se vergelyking toegepas op eenvoudige stromingsprobleme. Venturi-meter. Stroming deur openings onder konstante drukhoogte van water. Krag uitgeoefen deur 'n sproeier op 'n plat oppervlakte wat loodreg met die straal is. Hoeklemdigramme vir 'n middelpuntvliedende pomp.

TWEDE INGENIEUROFFISIER—HITTE EN HITTEMOTORE.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Elemente.—Temperatuur- en termometriese skale. Die herleiding van Celsius na Fahrenheit en omgekeerd. Lengte- en volume-uitsetting as gevolg van temperatuurveranderinge. Koëffisiënte en koëffisiëntverhoudings.*Hitte en hitte-oorbrenning.*—Hitte-eenhede: Britse Termiese Eenheid, Celsius-hitte-eenheid, gram-kalorie. Soortlike hitte. Meganiese hitte-ekwivalent. Hitte-ekwivalent van perdekrag. Hitte-oorbrenning deur geleiding, konveksie en straling. Die wette van geleiding en straling en eenvoudige toepassings met gegewe formules.*Mengsels.*—Hitte- en temperatuurprobleme waarby hoogstens drie stowwe getrokke is. Waterwaarde.*Gasse.*—Die wette van Boyle en Charles betreffende ideale gasse. Absoluut-temperatuur. Kenmerkende vergelyking. Konstante R en die gebruik daarvan by eenvoudige probleme. Isotermiese en adiabatiese uitsetting en verdigting. Verhouding tussen P, V en T wanneer $PV^n = \text{konstante}$. Soortlike hittede C_p en C_v en hul onderlinge verhouding.*Binnebrandmasjiene en lugperspomp.*—Grondbeginsels en werkingsiklusse. Berekening van gedane arbeid vanaf gegewe formules. Nokdiagramme vir binnebrandmasjiene, hoeke van nokpiekmiddellyne met betrekking tot einddruk.*Eienskappe van stoom.*—Verandering van aggregaattoestand. Meetbare hitte. Latente hitte. Nat stoom, droë versadigde waterdamp en oorverhitte stoom en die hoeveelhede hitte daarby betrokke. Die gebruik van verkorte Stoomtabelle. Spesifieke volume van stoom onder verskillende toestande. Smoring. Skei- en smoor-kalorimeters. Rendement van ketels. Ekwivalente verdamping. Gebruik van Stoomtabelle by eenvoudige probleme met betrekking tot kondensators. Uitwerking van luglekkasie.*Suierstoommasjien.*—Hipotetiese en werklike indikateurdiagramme. Diagramfaktor. Gemiddelde nuttige druk en gedane arbeid (as veronderstel word dat $PV = C$). Indikateur- en remperdekrag. Voordede van die gebruik van die ekspansiewerking van stoom en van hoë- en laedrukwerking. Gemiddelde ontwerpdruk. Stoomverbruik per uur en per perdekrag-uur. Termiese nuttige effek, meganiese rendement en totale rendement van enkelvoudige en saamgestelde masjiene. Warmtebalans met betrekking tot masjien- en ketelbeproeving.*Enkelvoudige skui- en suierkleppe met buite- of binne-stoomtoelating.* Gebruik van klepdiagramme om die voorloophoek, vooruitloop van stoomklep en stoomweg van 'n gegewe stoomskuifslag te bepaal.*Stoomturbine.*—Grondbeginsels. Eenvoudige snelheidsdiagramme. Termiese nuttige effek, meganiese rendement en totale rendement.*Verbranding.*—Soliede en vloeibare brandstowwe. Hoër en laer hittewaardes van brandstowwe. Chemiese vergelykings vir algehele verbranding. Teoretiese minimum-lug wat vereis word. Oormaat van lug.*Koelmasjinerie.*—Dampverdichtingsiklus. Verkoelingseffek. Vermoë van 'n masjien uitgedruk as „Tonne ys per vier-en-twintig uur vanaf en by 32°F.”*Ketels en verdampstoestelle.*—Digtheidsverandering as gevolg van besoedelde voeding.

HOOF-INGENIEUROFFISIER—HITTE EN HITTEMOTORE.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Elemente.—Uitsetting van vaste stowwe en vloeistowwe, insluitende koëffisiënt van skybare kubieke uitsetting. Die eerste wet in verband met termodinamika en die toepassing daarvan op konstante stromingstoestande. Formules vir gedane arbeid wat in verband gebring word met die formule $PV^n = C$.*Hitte-oorbrenning.*—Geleiding (uitgesonderd gemiddelde temperatuurverskil van log). Straling.*Eienskappe van stoom.*—Meetbare hitte; latente hitte; entalpie; inwendige energie; volume. Gebruik van Stoomtabelle en entropie Smoor- en skeikalorimeter.*Mengsels.*—Hitte- en temperatuurprobleme waarby twee of meer stowwe betrokke is.*Gasse.*—Die wet van Boyle. Die wet van Charles. Kenmerkende vergelyking. Verhoudings tussen P, V en T wanneer $PV^n = C$. Bepaling van n vanaf grafiek waardeur P en V verbind word. Bewys van die formule $C_p - C_v = \frac{R}{J}$. Berekenings vir uitsettings en verdichtings op lugperspomp, binnebrandmasjinerie, lugpomp en lugakkumulasie. Eenvoudige toepassings van die wet van Dalton in verband met eensydige drukings.

CHIEF ENGINEER-OFFICER—APPLIED MECHANICS.

(One paper of three hours. Six questions only out of nine to be attempted.)

Statics.—Laws of equilibrium. Moments and couples. Polygon of forces. Rapson's slide.*Friction.*—Law of dry friction. Friction angle. Friction clutches. Friction on inclined plane. Friction on threads. Work done against friction.*Kinematics.*—Linear and angular motion with constant acceleration. Gravitational acceleration. Velocity-time graphs.*Relative Velocity and Acceleration.*—Effect of a current on the velocity and course of a ship. Relative velocity between bodies moving in different planes.*Dynamics.*—Newton's law of motion. The force equation. Atwood machine. Acceleration of connected bodies. Effect of simple air resistance on motion under the effect of gravity. The torque equation. Conservation of momentum. Kinetic energy of translation and of rotation. Flywheels. Potential energy. Conservation of energy. Impulsive forces. Centrifugal force. Porter governor with sleeve friction. Simple harmonic motion. Simple pendulum. Simple vibrations. Dynamic balancing of masses rotating in one plane. Basic dynamics of the engine mechanism. Use of piston velocity and acceleration formulae. Derivation of piston displacement formula.*Machines.*—Velocity ratio. Mechanical advantage. Efficiency.*Stress and Strain.*—Direct stress and strain and modulus of elasticity. Shear stress and strain and modulus of rigidity. Stresses on oblique planes. Strength of simple connections such as cotttered or screwed joints. Resilience due to direct stress. Suddenly applied loads.*Compound Bars.*—Effects of direct loading and of temperature changes.*Beams.*—S.F. and B.M. diagrams for cantilevers and simply supported beams. Stresses in beams of simple section. Use of simple deflection formulae.*Torsion.*—Torsion equations for solid and hollow round shafts. Torsion of shaft fitted with liner. Horse-power transmitted. Close coiled helical spring.*Struts.*—Eccentric loading of short columns. Use of strut formulae.*Thin Shells.*—Stresses in thin shells. Design of riveted joints. Use of boiler shell design formulae.*Hydrostatics.*—Flotation in two liquids of different specific gravities. Total force and centre of pressure on immersed surfaces such as tanks and bulkheads.*Hydraulics.*—Bernoulli's equation applied to simple flow problems. Venturi meter. Flow through orifices under constant head. Force exerted by a jet on a flat surface perpendicular to the jet. Blade angle diagrams for a centrifugal pump.

SECOND ENGINEER-OFFICER—HEAT AND HEAT ENGINES.

(One paper of three hours. Six questions only out of nine to be attempted.)

Elements.—Temperature and thermometric scales. Conversion from Centigrade to Fahrenheit and vice versa. Linear and volumetric expansion due to temperature changes. Coefficients and the relationship between them.*Heat and Heat Transfer.*—Heat units: B.Th.U., C.H.U.; gram-calorie. Specific heat. Mechanical equivalent of heat. Heat equivalent of horse-power. Heat transfer by conduction, convection and radiation. Laws of conduction and radiation and simple applications with given formulae.*Mixtures.*—Heat and temperature problems involving not more than three substances. Water equivalent.*Gases.*—Boyle's and Charles' laws for perfect gases. Absolute temperature. Characteristic equation. Constant R and its use in simple problems. Isothermal and adiabatic expansion and compression. Relation between P, V and T when $PV^n = \text{constant}$. Specific heats C_p and C_v and the relationship between them.*I.C. Engines and Air Compressors.*—Elementary principles and cycles of operation. Calculation of work done from given formulae. Cam diagrams for I.C. engines, angles of cam peak centre lines relative to crank.*Properties of Steam.*—Change of state. Sensible heat. Latent heat. Wet, dry-saturated and superheated steam and the quantities of heat involved. Use of abridged steam tables. Specific volume of steam under various conditions. Throttling. Separating and throttling calorimeters. Boiler efficiency. Equivalent evaporation. Use of steam tables in simple problems, referring to condensers. Effect of air leakage.*Reciprocating Steam Engine.*—Hypothetical and actual indicator diagrams. Diagram factor. Mean effective pressure and work done (assuming $PV = C$). Indicated and brake horse-power. Advantages of using steam expansively and of compounding. Mean referred pressure. Steam consumption per hour and per horse-power-hour. Thermal, mechanical and overall efficiencies of simple and compounded engines. Heat balance for engine and boiler trials.

Simple slide and piston valves with outside or inside steam admission. Use of valve diagrams to determine angle of advance, lap, lead and port opening for a given valve travel.

Steam Turbine.—Elementary principles. Simple velocity diagrams. Thermal, mechanical and overall efficiency.*Combustion.*—Solid and liquid fuels. Higher and lower calorific values. Chemical equations for complete combustion. Theoretical minimum air required. Excess air.*Refrigeration.*—Vapour-compression cycle. Refrigerating effect. Capacity of a machine expressed as "Tons of ice per 24 hours from and at 32°F."*Boilers and Evaporators.*—Change of density due to contaminated feed.

CHIEF ENGINEER-OFFICER—HEAT AND HEAT ENGINES.

(One paper of three hours. Six questions only out of nine to be attempted.)

Elements.—Expansion of solids and liquids including coefficient of apparent cubical expansion. First law of thermodynamics and its application to steady flow conditions. Formulae for work done associated with the formula $PV^n = C$.*Heat Transfer.*—Conduction (excluding log mean temperature difference). Radiation.*Properties of Steam.*—Sensible heat; latent heat; enthalpy; internal energy; volume. Use of steam tables and entropy. Throttling and separating calorimeter.*Mixtures.*—Heat and temperature problems involving two or more substances.*Gases.*—Boyle's law. Charles' law. Characteristic equation. Relations between P, V and T when $PV^n = C$. Determination of n from graph connecting P and V.Proof of the formula $C_p - C_v = \frac{R}{J}$. Calculations for expansions and compressions on air compressors, internal combustion engines, air pumps and air storage. Simple applications of Dalton's law of partial pressures.

Gassiklusse.—Gebruik van entropiekaarte. Konstante-volumesiklus. Dieselsiklus. Ope en geslote siklusse vir gasturbines. Termies nuttige effek van indikateur en rem. Meganiese rendement. Totale rendement. Morse-toets.

Uitsetting van stoom.—Smoring. Hipotetiese PV-diagramme. Gedane arbeid, gemiddelde nuttige druk, diagramfaktor, insluitende die uitwerking van vryruimte. Hoë en laedrukwerking. Gemiddelde ontwerpdruk. Totale krag. Gekombineerde diagramme. Reuleaux-klepdigram.

Stoomsiklus.—Gebruik van entropiekaarte. Basiese Rankine-siklus. Hitteverlies in suiermasjiene en in turbines. Uitwerking op termies nuttige effek van wysigings soos oorverhitting, afvoerturbine- en regeneratorvoedingsverhitting. Ekwiwalente verdamping. Rendemente.

Digtheid en ketelsteen.—Basiese berekenings van die uitwerking van kondensator-lekkasie en onsuivere voeding op die digtheid en ketelsteen in ketels. Basiese berekenings van prestasie van verdampstoestel.

Turbine.—Basiese siklus en die wysigings daarvan. Stroming deur straalpype (uitgesonderd bewys van kritiese drukverhouding). Lemdiagramme vir aksie- en reaksie-turbines. Krag op lemme. Gedane arbeid op lemme. Gebruik van totale hittekaarte om die stoomtoestand in verskillende stadiums te bepaal.

Verbranding.—Verbrandingsvergelykings. Berekening van teoretiese lug wat vir verbranding vereis word. Bepaling van hittewaarde. Avogadro se hipotese. Basiese ontleding van uitlaatgasse. Verhouding tussen volumetriese en gewigsontleiding van 'n gasmengsel. Kooldioksied-inhoud van uitlaatgasse.

Koelmasjinerie.—Omgekeerde Carnot-siklus. Dampdruksiklus. Gebruik van damptafels. Prestasiekoëffisiënt.

TWEDE INGENIEUROFFISIER—TEKENE.

(Een vraestel van ses uur. Daar sal 'n keuse wees tussen twee tekenings.)

Die vraestel in Tekene sal bestaan uit 'n toets van die kandidaat se vermoë om die beginsels van projeksie toe te pas en kandidate sal gevra word om 'n plan, vertikale projeksie of dwarsdeursnit of kombinasie van hierdie aansigte van 'n stuk skeepsmasjinerie te teken volgens gegewens wat verskaf word. Al die nodige gegewens vir die voltooiing van die tekening sal in die vraestel verstrekk word.

VAKKE WAARVAN PRAKTIESE KENNIS VEREIS WORD.

DEEL B.

LET WEL.—Die opmerkings by „Vakke waarvan 'n Basiese Kennis vereis word”, Deel A, geld in gelyke mate vir Deel B.

TWEDE INGENIEUROFFISIER—ELEKTROTEGNIK.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Algemeen.—Die werking van 'n elektriese stroom—chemiese, magnetiese en termiese werking en verskaffing van lig. Opwekking van elektromotoriese krag deur chemiese, magnetiese, termiese en verligtingsmiddels.

Die elektriese kragkring.—Eenhede—ampère, ohm en volt. Die wet van Ohm. Hoofstroom- en parallelstroombane van E.M.K.-bronne en van weerstandsbronne. Stroomverdeling in eenvoudige stroombane. Die verskil tussen elektromotoriese krag en potensiaalverskil. Krag en energie. Verhoudings tussen warmteverwerking, meganiese en elektriese eenhede. Die ekwiwalent van Joule. Geleier-weerstand, uitwerking van lengte, oppervlakte, materiaal en temperatuur. Soortlike weerstand. Temperatuurkoëffisiënt van weerstand. Tipes isolasie. Die Wheatstonebrug (weerstandstroommeteter), die skuifdraadbrug. Toepassings op stuurinrigtings, weerstandspiometers, spanningsmeters, ens.

Elektrolitiese werking.—Die teorie van elektrolitiese dissosiasie toegepas op algemene oplossings, ens., aangesuurde water, koper-sulfaat en soutwater. Gebruik van elektrolise. Die wette van Faraday. Elektro-chemiese ekwiwalent.

Selle.—Primêre (nat of droë Leclanché-element) en sekondêre (suur- of alkaliese) tipes. Die bou en beginsels van selle. Die instandhouding en lading van selle. Watt-uur- en ampère-uurrendemente.

Magnetisme en elektro-magnetisme.—Eenvoudige teorie van magnetisme. Die magnetiese stroomveld. Kraglyne. Sterkte van stroomveld. Intensiteit van stroomveld. Magnetiese stroomvelde as gevolg van stroom in reguit geleiers, lusgeleidings, spoel en solenoides. Betrekklike rigtings van stroom en stroomveld. Uitwerking van yster. Stroomdigtheid. Totale stroming. Deurdringbaarheid. Tiperende B/H- en μ /B-krommes.

Elektro-magnetiese induksie.—Die wette van Faraday en Lenz. Omvang en rigting van geïnduseerde elektromotoriese krag. Krag opgewek op 'n stroomdraende geleier.

Wisselstroomteorie.—Die sinusoidale golf, frekwensie, maksimum, effektiewe en gemiddelde waardes. Voorstelling van wisselstroomhoeveelhede deur middel van vektors. Faseverskil. Die wisselstroomkragkring. Die induktor. Induktans en die uitwerking daarvan op die stroombaan. Die kapasitor. Kapasitans en die uitwerking daarvan op die stroombaan. Die algemene hoofstroomkragkring. Die verhouding tussen weerstand, reaktans en impedans. Eenvoudige behandeling van die kragfaktor.

Instrumente.—Die beginsels en funksie van elektriese skakelbordinstrumente. Beweegbare-spoel-, beweegbare-yster- en dinamometertipes. Die gebruik van newestroom- en hoofstroomweerstande om die werkingsfeer te vergroot. Die stroomtransformator en spanningstransformator vir instrumentewerk (beskrywing en eenvoudige verduideliking).

Toetsingsmetodes en metings.—Weerstand gemeet deur ammeter-voltmeter, deur brug (weerstandsmeter) en deur instrument. Eenvoudige toetsing van ohmte en isolasie. Algemene toetsing van isolasie, bestendigheid en millivolt-verlies. Nasporing van foute. Meting van temperatuur deur weerstand.

Kragkringe.—Eendraad-, tweedraad-, driedraad- en hoofringleidingstelsels vir gelykstroom. Die gebruik van smeltdrade en stroomonderbrekers. Die gebruik van aardlampe. Eenvoudige verwysing na die vereffeningdinamo. Eenvoudige verduideliking van die wisselstroomdinamo as 'n ontwikkelingsseenheid. Die parallelsakeling en sinchroniseringsprosedure.

Elektriese masjiene.—Besonderhede in verband met die bou van gelykstroomgenerator en -motor. Die werking van die stroomwisselaar. Eenvoudige benadering van oorlap- en golfbewikkelings. Metodes om die stroomveld van krag te voorsien—opwekking deur afsonderlike bewikkeling, opwekking deur newestroombewikkeling of hoofstroombewikkeling en opwekking deur dubbele bewikkeling.

Gelykstroomgenerators.—Besonderhede in verband met die bou van gelykstroomgenerators. Beskerming. Vergelyking van elektromotoriese krag en stroomspanningsbelasting. Kort bespreking oor die teorie van selfopwekking. Eienskappe van belasting. Metodes om stroomspanning te beheer. Parallelwerkingsprosedure.

Gelykstroommotore.—Besonderhede in verband met die bou van gelykstroommotore. Noodsaaklikheid van aansitters. Aansittertipes. Snelheids- en momentkoppelvergelykings. Eienskappe van belasting. Snelheidsbeheer.

Elektriese ontsteking vir binnebrandmasjiene.—Spoel- en magneto-stelsels. Aansit-inrigting. Instandhoudingsvereistes.

Gas Cycles.—Use of entropy charts. Constant volume cycle. Diesel cycle. Open and closed cycles for gas turbines. Indicated and brake thermal efficiencies. Mechanical efficiency. Overall efficiency. Morse test.

Expansion of Steam.—Throttling. Hypothetical PV diagrams. Work done, m.e.p., diagram factor, including effect of clearance. Compounding. Mean referred pressure. Total power. Combined diagrams. Reuleaux valve diagram.

Steam Cycle.—Use of entropy charts. Basic Rankine cycle. Heat drop in reciprocating engines and in turbines. Effect on thermal efficiency of such modifications as superheating, exhaust turbine and regenerative feed heating. Equivalent evaporation. Efficiencies.

Density and Scale.—Basic calculations on the effect of condenser leakage and impure feed on the density and scale in boilers. Basic calculations on evaporator performance.

Turbine.—Basic cycle and its modifications. Flow through nozzles (excluding proof of critical pressure ratio). Blade diagrams for impulse and reaction turbines. Force on blades. Work done on blades. Use of total heat charts to determine steam condition at various stages.

Combustion.—Combustion equations. Calculation of theoretical air required. Determination of calorific value. Avogadro's hypothesis. Basic analysis of exhaust gases. Relation between volumetric and weight analysis of a gas mixture. CO content of exhaust gases.

Refrigeration.—Reversed Carnot cycle. Vapour compression cycle. Use of vapour tables. Coefficient of performance.

SECOND ENGINEER-OFFICER—DRAWING.

(One paper of six hours. A choice of two drawings will be given.)

The Drawing Paper will consist of a test of the ability to apply the principles of projection, and candidates will be asked to draw a plan, elevation or section or a combination of these views of a piece of marine machinery from information supplied. All the required information for the completion of the drawing will be given in the question paper.

PRACTICAL KNOWLEDGE SUBJECTS.

PART B.

N.B.—The notes under "Fundamental Knowledge Subjects", Part A, apply equally to Part B.

SECOND ENGINEER-OFFICER—ELECTROTECHNOLOGY.

(One paper of three hours. Six questions only out of nine to be attempted.)

General.—Effects of electric current—chemical, magnetic, thermal and production of light. Production of e.m.f. by chemical, magnetic, thermal and light means.

The Electric Circuit.—Units—ampere, ohm and volt. Ohm's law. Series and parallel circuits of sources of e.m.f. and of resistances. Current distribution in simple circuits. Difference between e.m.f. and p.d. Power and energy. Relationships between heating, mechanical and electrical units. Joule's equivalent. Conductor resistance, effect of length, area, material and temperature. Specific resistance. Temperature coefficient of resistance. Types of insulation. Wheatstone network bridge, slide wire bridge. Applications to steering gears, resistance pyrometers, strain gauges, etc.

Electrolytic Action.—Theory of electrolytic dissociation applied to common solutions, etc., acidulated water, copper sulphate and salt water. Uses of electrolysis. Faraday's laws. Electro-chemical equivalent.

Cells.—Primary (wet or dry Leclanché) and secondary (acid or alkaline) types. Construction and principles. Maintenance, charging. Watt-hour and ampere-hour efficiencies.

Magnetism and Electromagnetism.—Simple magnetic theory. Magnetic field. Lines of force. Field strength. Field intensity. Magnetic fields due to current in straight conductors, loops, coils and solenoids. Relative directions of current and field. Effect of iron. Flux density. Total flux. Permeability. Typical B/H and μ /B curves.

Electro-magnetic Induction.—Faraday's and Lenz's laws. Magnitude and direction of induced e.m.f. Force produced on a current-carrying conductor.

Alternating Current Theory.—The sinusoidal wave, frequency, maximum, r.m.s. and average values. Vector representation of a.c. quantities. Phase difference. The a.c. circuit. The inductor. Inductance and its effect on the circuit. The capacitor. Capacitance and its effect on the circuit. The general series circuit. Relationship between resistance, reactance and impedance. Simple treatment of power factor.

Instruments.—Principles and function of switchboard indicating instruments. Moving-coil, moving-iron and dynamometer types. Uses of shunts and series resistances to increase the range. The current transformer and potential transformer for instrument work (description and simple explanation).

Testing Methods and Measurements.—Resistance measured by ammeter-voltmeter, by bridge and by instrument. Simple ohmmeter and insulation testing. General insulation, continuity and millivolt-drop testing. Fault tracing. Temperature measurement by resistance.

Circuits.—Single-wire, 2-wire, 3-wire and ring main systems for d.c. Use of fuses and circuit-breakers. Use of earth lamps. Simple reference to the balancer. Simple explanation of the alternator as a generating unit. Parallel running and synchronising procedure.

Electrical Machines.—Constructional details of the d.c. generator and motor. Action of commutator. Simple approach to lap and wave windings. Methods of supplying the field—separate excitation, shunt, series and compound windings.

D.C. Generators.—Constructional details. Protection. E.m.f. and load voltage equation. Brief treatment of theory of self-excitation. Load characteristics. Methods of voltage control. Parallel operation procedure.

D.C. Motors.—Constructional details. Need for starters. Types of starter. Speed and torque equations. Load characteristics. Speed control.

Electric Ignition for I.C. Engines.—Coil and magneto systems. Starting arrangements. Maintenance requirements.

HOOF-INGENIEUROFFISIER—ELEKTROTEGNIK.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Eenhede.—S.G.S.-stelsel en M.K.S.-stelsel.*Die magnetiese kragkring.*—B-H- en B-AT/sm.-krommes. Hul uitwerking op die ontwerp van eenvoudige magnetiese stroombane waarby 'n lugtussenruimte betrokke is. Histerese. Elektro-magnetisme. Wederkerige induksie.*Die elektriese kragkring.*—Die wette van Kirchoff. Parallelwerking van batterye met ongelyke elektromotoriese kragte en verskillende inwendige weerstande.

Stroomverdelingsprobleme. Volt-verlies. Verdelers met enkele en dubbele kragtoevoer. Hoofringleidings. Stroomverdelingsstelsels. Gelykstroom tweedraad en driedraad. Wisselstroom eenfasig en driefasig, driedraad en vierdraad. Vergelyking van koper wat vereis word.

Vereffeningsdinamo in driedraad-gelykstroomstelsel.

Motor-aansitters.—Outomatiese tipes—verwysing na tyd- en stroombeheer. Die trommelskakelaar vir hoofstroommotore.*Toepassings, ens.*—Parallelwerking van newestroomdinamo en dinamo met gemengde skakeling (sjunt en serie). Spanningsverdelers. Belastingsverdeling kwalitatief behandel. Toepassings op die Ward Leonard-stelsel. Stuurinrigting. Geskiktheid van gelykstroommotore vir die verskillende soorte werk.

Defekte en instandhouding van masjiene. Oorverhitting as gevolg van meganiese en elektriese defekte. Vonke by borsels. Verlies van remanente magnetisme; ens. Toetsingsmasjiene—gebruik van die megger.

Eenvoudige berekenings oor aansitters.

Algemeen.—Opwekking van 'n wisselstroom-golfvorm. Die sinus-wet. Frekwensie, siklus, afwykings-, momentane en maksimum-waardes. Verhouding tussen frekwensie, aantal pole, en snelheid van 'n masjien. Effektiewe en gemiddelde waardes. Die vormfaktor. Voorstelling van 'n wisselstroomhoeveelheid deur middel van vektors om momentane en effektiewe waardes te verskaf.*Die hoofstroomkragkring.*—Weerstand, induktans en impedans. Stroom- en stroomspanningsverhoudings. Die gebruik van vektors. Krag, skynbare krag (volt-ampère), reaktiewe volt-ampère- en kragfaktor. Die impedans-driehoek. Reaktiewe en aktiewe bestanddele van stroom.*Die parallelstroombaan.*—Behandeling slegs deur vektors van redelike eenvoudige stroombane. Kapasitans en die toepassing van kapasitors op kragfaktorverbetering. Die wenslikheid van hoë kragfaktore.*Driefasige stelsels.*—Ster- en delta-(driehoek)-skakelings vir kragbronne en belastings. Fase- en lynverhoudings. Krag. Driefasige vierdraad-verdeler. Die toepassing op die roterende magnetiese stroomveld.*Wisselstroomdinamo's.*—Die bou van wisselstroomdinamo's. Elektromotoriese kragvergelijking. Synchronisering en verwysing na belastingsverdeling.*Induksiemotore.*—Die bou van induksiemotore. Slip. Verwysing na die elektromotoriese krag en frekwensie van rotor. Tiperende momentkoppel-snelheidskrommes. Bewikkelde, sleep-ring- en kou-tipes. Beskrywing van dubbelbewikkelde tipe. Metodes van aansit.*Sinchroommotore.*—Die bou van sinchroommotore. Metodes van aansit. Verwysing na die gebruik daarvan vir kragfaktorverbetering.*Vergelyking.*—Algemene vergelyking van een- en driefasige stelsels, met aanduiding van die kostebesparing van 'n driefasige stelsel.*Aandrywing.*—Tipes wat van gelykstroom- en wisselstroommasjiene gebruik maak. Turbine-elektriese aandrywings; metodes van aansit; verandering van snelheid. Voordele en nadele van elektriese aandrywing.*Eenfasige motore.*—Beskrywing van algemene gewone tipes. Metode van aansit.*Transformators.*—Elementêre grondbeginsels en algemene beskrywing.*Instrumente.*—Eenvoudige behandeling (kwalitatief) van dinamometer, wattmeter, frekwensiemeter, kragfactormeter, draaisin-chroskoop.

TWEDE INGENIEUROFFISIER—ELEMENTÊRE SKEEPSONTWERP.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Algemeen.—Verplasing. Nat vlak. Blok-, middeldeursnee-, prismatiese en watervlak-oppervlaktekoeffisiënt. Ton per duim indompeling. Toepassing van Simpson se eerste reël op oppervlaktes en volumes.*Diepgang en dryfvermoë.*—Verandering van gemiddelde diepgang as gevolg van verandering in die digtheid van die water. Dryfvermoë en reserwe-dryfvermoë. Uitwerking wanneer kompartemente midskeeps vol water laat loop word.*Buigstabiliteit.*—Verskuiwing van die swaartepunt as gevolg van die bylaai of verwydering van ballas, brandstof of vrug. Stabiliteit onder klein slagsyhoëke (met die tweede moment van oppervlakte van die watervlak of formules aangegee). Die hellingseksperiment.*Weerstand en aandrywing.*—Vergelyking van huidwrywingsweerstand van romp met model by verskillende snelhede. $R_f = f.S.V^n$. (R = weerstand; f = wrywingskoeffisiënt; S = nat vlak; V = snelheid; n = snelheidsindeks). Admiraliteits- en brandstofkoeffisiënte. Verhouding tussen snelheid van skip en brandstofverbruik met konstante verplasing en gestel dat weerstand afwissel as (snelheid)ⁿ. Elementêre behandeling van die skroef. Skroefstyging, skynbare slip, werklike slip, volgstroom, stukrag en vermoë.*Struktuursterkte.*—Eenvoudige probleme oor die sterkte van boudele om vloeistofdruk te weerstaan. Belasting weens die drukhoogte van vloeistof.*Skeepsboukunde.*—Die algemene uitdrukkings wat gebruik word by die meting van staalskepe, bv. lengte tussen die loodlyne, totale breedte, holte ooreenkomstig die mal, diepgang en vryboord. Omskrywings van skeepsbou-uitdrukkings wat algemeen gebruik word. Beskrywings en sketse van boudele in gewone soorte staalskepe. Masjineriefundamente-inrigtings. Waterdigte deure. Luik. Roere. Skroewe. Skroefaskokers. Waterdigte beskotte. Dubbelbodems. Ankers en kables. Voorsorgsmaatreëls wat getref moet word voordat leë oliebrandstof- of ballastens binnegegaan word.

Die versorging van die skip se struktuur, veral die kimme, bunkers, tenks onder stoomketels en waterdigte deure. Ventilasië-inrigtings (natuurlik en meganies) vir pompkamers in tenkskepe en vir die skeepsruime, bunkers en oliebrandstof-tenks. Stuwings van kool. Selfontbranding van kool. Die gevaar van ontploffings van gas wat deur kool afgegee word.

Brandopsporing en brandblussingsinrigtings vir passasiers- en vrugruime. Voorsorgsmaatreëls teen brand in hawe en droogdok. Piektenks voor en agter, inrigtings vir die volmaak- en uitpomp van dubbelbodems- en dieptenks. Dreinerings van kompartemente.

Inrigtings vir die normalisering van beskadigde kantkompartemente van skepe.

Droogdok-inrigtings en die instandhouding van onderwatertoebehoere.

HOOF-INGENIEUROFFISIER—ELEMENTÊRE SKEEPSONTWERP.

(Een vraestel van drie uur. Slegs ses uit nege vrae moet beantwoord word.)

Algemeen.—Vormkoeffisiënte. Natvlakformules. Die eerste reël van Simpson toegepas op oppervlaktes, moment van oppervlaktes, tweede momente van oppervlaktes, volumes, momente van volumes, swaartepunte en drukpunte.*Buigstabiliteit.*—Swaartepunt. Dryfvermoëpunt. Metasentrum. Moment van statiese stabiliteit. GZ-krommes. Dwarskrommes van stabiliteit. Hidrostatiese krommes wat algemeen vir skepe verskaf word. Die uitwerking van vrye vloeistofoppervlakte en onderverdeling van tenks. Gevaar as gevolg van waterophoping tydens brandblussing. Die uitwerking van hangende gewigte. Praktiese vereistes om stabiliteit ter see te verseker. Die bestuur van water- en brandstof-tenks. Die volmaak en leegmaak van tenks ter see.*Oorlangse stabiliteit.*—Oorlangse BM- en GM-stabiliteit en statiese stabiliteit. Dryfmiddelpunt en die berekening daarvan. Moment om trim met een duim te verander.

CHIEF ENGINEER-OFFICER—ELECTROTECHNOLOGY.

(One paper of three hours. Six questions only out of nine to be attempted.)

Units.—C.G.S. system. M.K.S. system.

The Magnetic Circuit.—B-H and B-AT/cm curves. Their effect on the design of simple magnetic circuits involving an air gap. Hysteresis. Electromagnetism. Mutual induction.

The Electric Circuit.—Kirchoff's laws. Parallel operation of batteries with unequal e.m.f.s. and differing internal resistances. Distribution problems. Volt-drop. Singly and doubly fed distributors. Ring mains. Distribution systems. D.c. 2-wire and 3-wire. A.c. single-phase and three-phase 3-wire and 4-wire. Comparison of copper required. Balancer in 3-wire d.c. system.

Motor Starters.—Automatic types—reference to time and current control. The drum controller for series motors.

Applications, etc.—Parallel operation of shunt and compound generators. Equalising bar. Load sharing treated qualitatively. Applications to Ward Leonard system. Steering gear. Suitability of d.c. motors for the various types of work. Faults and maintenance of machines. Overheating due to mechanical and electrical defects. Sparking at brushes. Loss of residual magnetism, etc. Testing machines—use of the megger. Simple calculations on starters.

General.—Production of an alternating waveform. The sine law. Frequency; cycle; amplitude, instantaneous and maximum values. Relation between frequency, number of poles and speed of a machine. R.M.S. and average values. Form factor. Representation of an alternating quantity by means of vectors to give instantaneous and R.M.S. values.

The Series Circuit.—Resistance, inductance and impedance. Current and voltage relationships. Use of vectors. Power, apparent power (VA) reactive volt-ampere and power factor. The impedance triangle. Reactive and active components of current.

The Parallel Circuit.—Treatment by vectors only of fairly simple circuits. Capacitance and the application of capacitors to power factor improvement. The desirability of high power factors.

Three-phase Systems.—Star and delta (mesh) connections for supplies and loads. Phase and line relationships. Power. Three-phase 4-wire distributor. The application to the rotating magnetic field.

Alternators.—Construction. E.m.f. equation. Synchronising and reference to load sharing.

Induction Motors.—Construction. Slip. Reference to rotor e.m.f. and frequency. Typical torque-speed curves. Wound, slip ring and cage types. Description of double wound type. Starting methods.

Synchronous Motors.—Construction. Starting methods. Reference to use for power factor correction.

Comparison.—General comparison of single- and three-phase systems bringing out the saving in cost of a three-phase system.

Propulsion.—Types using d.c. and a.c. machines. Turbo-electric drives; starting methods; speed changing. Advantages and disadvantages of electrical propulsion.

Single-phase Motors.—Description of general common types. Starting.

Transformers.—Elementary principles and general description.

Instruments.—Simple treatment (qualitative) of dynamometer, wattmeter, frequency meter, power factor meter, rotary synchroscope.

SECOND ENGINEER-OFFICER—ELEMENTARY NAVAL ARCHITECTURE.

(One paper of three hours. Six questions only out of nine to be attempted.)

General.—Displacement. Wetted surface. Block, mid-section, prismatic and water-plane area coefficient. Tons per inch immersion. Application of Simpson's first rule to areas and volumes.

Draught and Buoyancy.—Alteration of mean draught due to change in density of water. Buoyancy and reserve buoyancy. Effect of bilging amidship compartments.

Transverse Stability.—Shift of centre of gravity due to addition or removal of ballast, fuel, or cargo. Stability at small angles of heel (given the second moment of area of the waterplane or formulae). The inclining experiment.

Resistance and Propulsion.—Comparison of skin frictional resistance of hull with model at different speeds. $R_f = f.S.V^n$. Admiralty and fuel coefficients. Relation between speed of vessel and fuel consumption with constant displacement and assuming that resistance varies as (speed)ⁿ. Elementary treatment of propeller. Pitch, apparent slip, real slip, wake, thrust and power.

Structural Strength.—Simple problems on strength of structural members to resist liquid pressure. Loading due to head of liquid.

Ship Construction.—Common terms used in the measurement of steel ships, e.g. length between perpendiculars, breadth overall, moulded depth, draught and freeboard. Definitions of shipbuilding terms in general use. Descriptions and sketches of structural members in ordinary types of steel ships. Machinery seating arrangements. Watertight doors. Hatches. Rudders. Propellers. Stern tubes. Watertight bulkheads. Double bottoms. Anchors and cables. Precautions necessary before entering empty oil fuel or ballast tanks.

The preservation in good condition of the ship's structure, in particular the bilges, bunkers, tanks under boilers and watertight doors. Ventilation arrangements (natural and mechanical) for pump rooms in tankers and for holds, coal bunkers and oil fuel tanks. Storage of coal. Spontaneous combustion. Danger of explosion from gas given off by coal. Fire detection and extinction arrangements for passenger and cargo spaces. Fire precautions in port and dry dock. Fore and aft peak tanks, double bottom and deep tank filling and pumping arrangements. Compartmental drainage. Levelling arrangements for damaged side compartments.

Dry docking and maintenance of underwater fittings.

CHIEF ENGINEER-OFFICER—ELEMENTARY NAVAL ARCHITECTURE.

(One paper of three hours. Six questions only out of nine to be attempted.)

General.—Form coefficients. Wetted surface formulae. Simpson's first rule applied to areas, moment of areas, second moments of areas, volumes, moments of volumes, centroids and centres of pressure.

Transverse Stability.—Centre of gravity. Centre of buoyancy. Metacentre. Moment of statical stability. GZ curves. Cross curves of stability. Hydrostatic curves commonly supplied to ship. Effect of free liquid surface and subdivision of tanks. Dangers due to water accumulation during fire-fighting. Effect of suspended weights. Practical requirements to ensure stability at sea. Management of water and fuel tanks. Filling and emptying tanks at sea.

Longitudinal Stability.—Longitudinal BM and GM and statical stability. Centre of flotation and its calculation. Moment to change trim by one inch.

Diepgang, trim en oorhelling.—Veranderings as gevolg van die bylaai of verwydering van brandstofballas of vrag. Veranderings as gevolg van verandering in die digtheid van soutwater. Veranderings as gevolg daarvan dat kompartemente vol water laat loop word, waarby gebruik gemaak word van die dryfvermoëverlies- en vermeerde gewigsmetodes. Kragte op die roer en spanning in die roerstok. Oorhelling wanneer die skip draai, insluitende die uitwerking van die middelpuntvliedende krag en van die roer.

Weerstand en aandrywing.—Afleiding van Admiraliteits- en brandstofkoëffisiënte. Oorweging van totale weerstand as die som van wrywings- en remanente weerstand. Die wet van ooreenstemmende snelheid. Froude se wet van vergelyking. Eenvoudige probleme oor die bepaling van volskaalse weerstand vanaf model eksperimente. Eenvoudige probleme waarby die gebruik van effektiewe perdekrags, opgelewerde perdekrags en kwasi-aandryfkoëffisiënt betrokke is. Eenvoudige probleme oor skroewe. Skroefstygingsverhouding. Volg-stroomfaktor. Werklike slip. Skynbare slip. Stukrag en vermoë. Kavitasie.

Skeepsboukunde.—Kragte op skip onder verskillende toestande, insluitende die uitwerking van die klopping en trilling van motore. Die bou van alle dele van staalskepe. Strukturele brandbeskermingsinrigtings. Brandopsporing en brandblussingsinrigtings. Voorsorgsmaatreëls teen brand in hawe en droogdok. Die stuwang en ventilering van kool. Die gevaar van ontploffings van gas wat deur kool afgegee word. Kim- en ballas-inrigtings. Inrigtings vir die normalisering van beskadigde kantkompartemente van skepe. Droogdok-inrigtings. Die ventilering van die skeepsruim en oliebrandstofstanks.

Meting en klassifikasie van skepe.—Die betekenis van „geklassifiseerde” en „ongeklassifiseerde” skepe. Drie-eilanddekskepe en skuildekskepe. Algemene uitdrukkings wat gebruik word by die meting van moderne staalskepe. Algemene uitdrukkings wat gebruik word by die meting van tonnemaat, bv. bruto-tonnemaat, netto-tonnemaat, vergunning vir aandryfkrags, tonnemaatluike.

TWEEDE EN HOOF-INGENIEUROFFISIERS—INGENIEURSWESE.

Kandidate vir 'n gekombineerde Stoom- en Motorsertifikaat moet bereid wees om in al die items van (a) tot (w) eksamen te doen, maar diene vir 'n Stoomsertifikaat of die Stoomendossement van 'n Motorsertifikaat sal nie in items (q) tot (w) eksamen hoef te doen nie, en diene vir 'n Motorsertifikaat of die Motorendossement van 'n Stoomsertifikaat sal nie in items (j) tot (p) eksamen hoef te doen nie. Daarbenewens moet kandidate vir 'n sertifikaat vir 'n hoof-ingenieuroffisier of 'n endossement van 'n sertifikaat vir 'n hoof-ingenieuroffisier wat 'n grondiger kennis moet hê van die verskillende items in die leerplan as kandidate vir 'n sertifikaat vir 'n tweede ingenieuroffisier of 'n endossement van 'n sertifikaat vir 'n tweede ingenieuroffisier, bereid wees om in items (x) tot (y) eksamen te doen.

OPMERKINGS.

1. Die ingenieurskennis wat van kandidate verwag word, is dié wat vereis word vir die gebruik, bediening en onderhoud van die masjinerie, uitrusting en skeepsdele waarvoor die ingenieuroffisier gewoonlik verantwoordelik is. Kennis van die metodes vir die vervaardiging van die verskillende onderdele word ook vereis.

2. Kandidate vir sertifikate en endossement moet 'n skriftelike eksamen en daarna 'n mondelinge eksamen aflê.

3. Die skriftelike eksamen vir 'n Stoom- of Motorsertifikaat bestaan uit twee vraestelle van drie uur elk—net ses uit nege vrae in iedere vraestel moet beantwoord word.

4. Die skriftelike eksamen vir 'n gekombineerde Stoom- en Motorsertifikaat bestaan uit drie vraestelle van drie uur elk—net ses uit nege vrae in elke vraestel moet beantwoord word.

5. Die skriftelike eksamen vir 'n Stoom- of Motorendossement bestaan uit een vraestel van ses uur—net ses uit nege vrae in die vraestel moet beantwoord word.

6. Waar vrae met betrekking tot die hoof elektriese aandryfmasjinerie in die eksamen vir die Sertifikaat vir 'n Hoof-ingenieuroffisier of 'n endossement van die Sertifikaat vir 'n Hoof-ingenieuroffisier gestel word, sal die nege vrae vermeerder word met die aantal vrae wat oor die hoof elektriese aandryfmasjinerie gestel word.

7. Kandidate kan gevra word om hulle antwoorde met sketse uit die vry hand toe te lig.

(a) Die algemene uitwerking van die verskillende behandelings op die fisiese bestanddele van materiale wat gewoonlik by die bou van skeepsmasjiene en stoomketels gebruik word en die meganiese toetse waaraan hierdie materiale gewoonlik onderwerp word.

(b) Warmte en verbranding. Die eienskappe van stoom, brandstof, smeermiddels en ander vloeistowwe, gasse en dampe wat in verband met masjinerie aan boord gebruik word.

(c) Die gebruik, boubesonderhede en beginsels wat betrokke is by die werking van die drukmeter, voltmeter, ammeter, termometer, pirometer, barometer, salinometer, hidrometer en ander meters wat gewoonlik deur ingenieurs aan boord van 'n skip gebruik word.

(d) Die oorsake, uitwerking en gewone maatreëls teen ketelsteenvorming en korrosie. Voedingswater en blaasdigtheid en ketelsteenvorming.

(e) (1) Boubesonderhede en werkingsprinspe van skeepsmasjiene; metodes ter berekening van hulle remperdekrags. Die werkingsprinsiep en metodes vir die yking van dinamometers en wringingsmeters.

(2) Die metodes waarvolgens slytasie in masjinerie en stoomketels behandel word. Die rig van masjiendele. Die verhelping van defekte as gevolg van gebreke in die materiaal of ongeluk. Tydelike of permanente herstelwerk in die geval van 'n bedryfstesting of algehele weiering.

(f) Boubesonderhede en werkingsprinspe van sentrifugale, suier- en perspompe. Die algemene vereistes in verband met voedings-, brandstof-, vullings- en ballaspompstelsels.

(g) Die bou-inrigting, besonderhede en werking van stuurmasjiene en sturgerei, koelmasjinerie, hidrouliese masjinerie en die stoommasjiene en binnebrandmotore wat vir nood- en hulpmasjinerie aan boord gebruik word.

(h) Aansteking van die indikateur. Berekening van gemiddelde druk en perdekrags. Drukskommeling in die silinder soos aangewys deur indikatuurdiagramme.

(i) (1) Voorsorgsmaatreëls teen brand of ontploffings as gevolg van olie of gas. Flitspunt. Ontploffbaarheid van gas of damp wat afgegee word deur brand- of smeerolies wanneer dit met 'n hoeveelheid lug gemeng word. Die gevaar van lekkasie uit olietanks, pype, gasontwikkelaars en verdampers veral in kimme en ander ongeventileerde ruimtes. Die werking van draadgaasdiaphragmas en die plekke waarin dit aangebring moet word.

(2) Selfontbranding van steenkool. Ontploffbaarheid van gas wat deur kool afgegee word. Belugting en stuwang van kool.

(3) Brandopsporing. Metodes van brandbestryding. Werking en onderhoud van meganiese en chemiese brandblussers en ander brandbestrydingstoestelle, gasmaskers en veiligheidslampe.

(j) Die metodes vir die bou van skeepsstoommasjiene en stoomketels, die prosesse waaraan die verskillende dele onderwerp word of wat met die vervaardiging daarvan gepaard gaan en die metodes wat aangewend word by die montering van die masjinerie aan boord van 'n skip.

(k) Die verskillende soorte aandryf- en hulpstoommasjiene nou in gebruik, die funksies van elke belangrike deel daarvan en die sorg wat deur die verskillende dele van die masjinerie aan boord van 'n skip vereis word.

(l) Die metodes waarvolgens die stoominlaat- en -uitlaatkleppe getoets en gestel word en die uitwerking daarvan op die werking van die masjiene wanneer die kleppe op bepaalde maniere verstel word.

(m) Die boubesonderhede en werking van verdampers, voedingswaterverwarmers en voedingswaterfilters.

(n) Skeepsketels van verskillende moderne ontwerpe; die manier waarop hulle gestut word, asook die voorkoming van ketelverskuiwing wanneer bote hel en rol. Die vasstelling deur berekening van geskikte bedryfsdrukkings vir stoomketels van gegewe afmetings.

(o) Die gebruik en hantering van keteltoebehore en -beslag, veral met betrekking tot watermeters en veiligheidskleppe. Voorsorg wat getref moet word wanneer stoom ontwikkel en afsluitkleppe gewerk word, veral met betrekking tot die gevaar wat deur waterslagwerking ontstaan.

(p) Die boubesonderhede, bediening en onderhoud van installasies wat algemeen gebruik word om lugtrek, oorverhitting van stoom en die verbranding van kool of brandolie aan te help.

(q) Die beginsels wat aan die werking van binnebrandmotore ten grondslag lê. Die onderskeid tussen verskillende tipes motore. Boubesonderhede van binnebrandmotore in algemene gebruik.

(r) Die aard en eienskappe van die brand- en smeerolies wat algemeen vir binnebrandmotore gebruik word. Die toevoer van lug en brandstof na die silinders van verskillende tipes motore. Die boubesonderhede van toestelle vir die vergassing of verstuiwing van die brandstof. Die metodes ter verkoeling van die silinders en suiers. Boubesonderhede en werking van lugperspompe.

(s) Die metodes vir die bou van skeepsbinnebrandmotore. Die prosesse waaraan die verskillende dele daarvan onderwerp word of wat met die vervaardiging daarvan gepaard gaan en die metodes wat by die montering van masjinerie aan boord aangewend word.

(t) Aansit- en omstelinrigtings en die verskillende handelinge wat daarmee in verband staan.

Draught, Trim and Heel.—Changes due to adding or removing fuel ballast or cargo. Changes due to alteration in density of sea water. Changes due to bilging of compartments, using the lost buoyancy and added weight methods. Forces on rudder and stress in rudder stock. Heel when turning, including effect of centrifugal force and of rudder.

Resistance and Propulsion.—Derivation of Admiralty and fuel coefficients. Consideration of total resistance as the sum of frictional and residuary resistance. The law of corresponding speeds. Froude's law of comparison. Simple problems on the prediction of full scale resistance from model experiments. Simple problems involving the use of E.H.P., D.H.P., and Q.P.C. Simple problems on propellers. Pitch ratio. Wake factor. True slip. Apparent slip. Thrust and power. Cavitation.

Ship Construction.—Forces on ship under various conditions, including the effect of panting and pounding. Construction of all parts of steel ships. Structural fire protection arrangements. Fire detection and extinction arrangements. Fire precautions in port and in dry dock. Storage and ventilation of coal. Danger of explosion of gas given off by coal. Bilge and ballast arrangements. Levelling arrangements for damaged side compartments. Dry docking. Ventilation of holds and oil fuel tanks.

Ship Measurement and Classification.—Meaning of "classed" and "unclassed" ships. Three island and shelter deck vessels. Common terms used in measurement of modern steel ships. Common terms used in tonnage measurement, e.g. gross tonnage, nett tonnage, propelling power allowance, tonnage hatch.

SECOND AND CHIEF ENGINEER-OFFICERS—ENGINEERING KNOWLEDGE.

Candidates for a combined Steam and Motor Certificate must be prepared to be examined in all the items (a) to (w), but those for a Steam Certificate or the Steam Endorsement of a Motor Certificate will not be examined in items (q) to (w) and those for a Motor Certificate or the Motor Endorsement of a Steam Certificate will not be examined in items (j) to (p). In addition candidates for a Chief Engineer-Officer's Certificate or an endorsement of a Chief Engineer-Officer's Certificate, who will be expected to display a fuller knowledge of the different items in the Syllabus than candidates for a Second Engineer-Officer's Certificate or an endorsement of a Second Engineer-Officer's Certificate, must be prepared to be examined in items (x) to (y).

NOTES.

1. The Engineering Knowledge to be shown by candidates is that which is required for the use, operation and maintenance of the machinery, equipment and ship structure usually in the charge of the Engineer-Officer. A knowledge of the methods of manufacture of the various components is also required.

2. Candidates for certificates and endorsements are required to take a written examination followed by an oral examination.

3. The written examination for a Steam or Motor Certificate consists of two papers of three hours each—six questions only to be attempted out of nine in each paper.

4. The written examination for a combined Steam and Motor Certificate consists of three papers of three hours each—six questions only to be attempted out of nine in each paper.

5. The written examination for a Steam or Motor Endorsement consists of one paper of three hours—six questions only to be attempted out of nine in the paper.

6. Where questions relating to main electric propelling plant are asked in the examination for a Chief Engineer-Officer's Certificate or an endorsement of a Chief Engineer-Officer's Certificate, the nine questions set will be increased by the number of questions set on main electric propelling plant.

7. Candidates may be required to illustrate their answers by means of freehand sketches.

(a) The general effects of the various treatments on the physical properties of materials commonly used in the construction of marine engines and boilers, and the mechanical tests to which these materials are normally subjected.

(b) Heat and combustion. The properties of steam, fuel, lubricants and other liquids, gases and vapours used in machinery on board ship.

(c) The use, constructional details and principles involved in the action of the pressure gauge, voltmeter, ammeter, thermometer, pyrometer, barometer, salinometer, hydrometer and other meters commonly used by engineers on board ship.

(d) The causes, effects and usual remedies for incrustation and corrosion. Feed water and blow densities, and scale formation.

(e) (1) Constructional details and working principles of marine engines; methods of determining their B.H.P. The principle of working and methods of calibration of dynamometers and torsion meters.

(2) The methods of dealing with wear and tear of machinery and boilers. The alignment of machinery parts. The correction of defects due to flaws in material or accident. Temporary or permanent repairs in the event of derangement or total break down.

(f) Constructional details and principles of action of centrifugal, bucket and force pumps. The general requirements concerning feed, fuel, bilge and ballast pumping systems.

(g) The constructional arrangement, details and working of steering-engines and gears, refrigerating machinery, hydraulic machinery, and such steam and internal combustion engines as are used for emergency and auxiliary machinery on board ship.

(h) Application of the indicator. Calculation of mean pressure and horsepower. Fluctuation of pressure in the cylinder as shown by indicator diagrams.

(i) (1) Precautions against fire or explosions due to oil or gas. Flash point. Explosive properties of gas or vapour given off by fuel or lubricating oils when mixed with a quantity of air. The danger of leakage from oil tanks, pipes, gas producers and vaporisers, particularly in bilges and other unventilated spaces. The action of wire gauze diaphragms and the places in which such devices should be fitted.

(2) Spontaneous combustion of coal. Explosive properties of gas given off by coal. Ventilation and storage of coal.

(3) Fire detection. Methods of dealing with fire. Action and maintenance of mechanical and chemical fire extinguishers and other fire-fighting appliances, respirators and safety lamps.

(j) The methods of constructing marine steam engines and boilers, the processes to which the several parts are submitted, or which are incidental to their manufacture, and the methods employed in fitting the machinery on board ship.

(k) The various types of propelling and auxiliary steam engines now in use, the functions of each important part and the attention required by the different parts of the machinery on board ship.

(l) The methods of testing and altering the setting of the steam admission and exhaust valves, and the effect produced in the working of the engine by definite alterations in the settings of the valves.

(m) The constructional details and working of evaporators, feed water heaters and feed water filters.

(n) Marine boilers of various modern designs; the manner of staying them, and also the prevention of movement of boilers when vessels are pitching or rolling. The determination by calculation of suitable working pressures for boilers of given dimensions.

(o) The use and management of boiler fittings and mountings, with special reference to water gauges and safety valves. Precautions necessary when raising steam and operating stop valves, with particular reference to the danger arising from water hammer action.

(p) Constructional details, operation and maintenance of installations generally employed for assisting draught, superheating steam and burning coal or oil fuel.

(q) The principles underlying the working of internal combustion engines. The difference between various types of engines. Constructional details of internal combustion engines in general use.

(r) The nature and properties of the fuel and lubricating oils generally used in internal combustion engines. The supply of air and fuels to cylinders of engines of different types. The constructional details of apparatus for carburetting or atomising the fuel. The means of cooling the cylinders and pistons. Constructional details and working of air compressors.

(s) The methods of constructing marine internal combustion engines. The processes to which the several parts are submitted or which are incidental to their manufacture, and the methods employed in fitting the machinery on board ship.

(t) Starting and reversing arrangements and the various operations connected therewith.

- (u) Die sorg wat vereis word vir die bediening en onderhoud van die verskillende masjineriede. Die gebruik en hantering van kleppe, pype, verbindings en veiligheidsstoele wat gebruik word.
- (v) Die opnoem en beskrywing van defekte wat uit die werking van masjinerie ontstaan. Die verhelping van sulke defekte.
- (w) Die boubesonderhede en hantering van hulpketels, hulle toebehore en beslag, met spesiale verwysing na die waterpeilglas en veiligheidskleppe. Boubesonderhede en hantering van hulpmasjinerie.

KANDIDATE VIR DIE SERTIFIKAAT VIR 'N HOOF-INGENIEUROFFISIER EN 'N ENDOSSEMENT VAN SO 'N SERTIFIKAAT.

(x) Die administratiewe pligte van 'n hoof-ingenieuroffisier: organisasie van sy personeel vir noodpligte en die gebruik van veiligheids-uitrusting; organisasie van herstelwerk en opmetings. Verslae aan eienaars. Die onderhoud en bedryfstoeestand van masjinerie en toestelle waarvoor 'n senior ingenieuroffisier verantwoordelik is. Die sorg wat vereis word om weierings en defekte te voorkom. Die gewone herstelwerk en vernuwings wat vereis word; toetsing oor en inspeksie van masjinerie en stoomketels aan boord van 'n skip. Gereedmaking van stoomketels en masjinerie vir ondersoek.

(y) Die herkenning van onreëlmatigheid in die loop van masjiene vanaf indikateurdiagramme. Die regstelling van hierdie onreëlmatighede. Toelating deur middel van sketse van die verandering wat teweeggebring word in die diagram as gevolg van 'n verstelling of verandering in die werking van die kleppe of enige ander faktore.

MONDELINGE EKSAMEN.

Die mondelinge eksamen sal hoofsaaklik gebaseer word op die Praktiese Kennisvakke van die eksamen en sal vroeë insluit oor die hantering van masjiene en stoomketels ter see, die werksaamhede van die toesighoudende ingenieur, die werk wat aan masjiene, ketels en hulpmasjinerie in die hawe gedoen moet word en die periodieke ondersoek van die bewegende dele.

Kandidate moet ook ten volle bekend wees met masjinerie- en ketelbeskadiging wat op see kan plaasvind en moet kan verduidelik hoe dit voorkom en verhelp kan word.

BYLAE D.

LEES VAN DIE WATERPEILGLAS.

Ondanks die feit dat die lees van die waterpeilglas 'n spesiale kenmerk is van die eksaminering van ingenieuroffisiere vind baie ongelukke by die ketels plaas as gevolg van die feit dat die ingenieuroffisier van die wag nie vertrou is met die bou van die waterpeilglas toebehore nie of nie deur werklike proefneming verseker dat die kraan, pype, ens., onbelas is nie.

Tensy 'n kandidaat wat geëksamineer word, kan bewys dat hy begryp hoedat hy die aanduidings van die waterpeilglas moet verifieer, kan hy nie in praktiese kennis slaag nie. As 'n kandidaat in praktiese kennis druip, beteken dit dat hy verdere ondervinding van seidiens moet opdoen voordat hy 'n hereksamen mag aflê.

Die sketse, figure 1, 2, 3, 4 en 5 van Plaat 1, verteenwoordig die gebruiklike metodes waarvolgens waterpeilglasmonterings aan marineketels vasgeheg word, met die rookaste geriefshalwe, by figure 3, 4 en 5 weggelaat. Die belangrike kenmerke in elke waterpeilglas en die metode om die aanduidings daarvan te verifieer, word afsonderlik in die volgende notas behandel.

MET BETREKKING SLEGS TOT FIGUUR 1.

In hierdie geval is die waterpeilglaskraan regstreeks aan die ketel vasgeheg, en die akkuraatheid van die peilglas wanneer die ketel onder stoom is, kan soos volg getoets word:—

Eerstens.—Laat B oop bly, draai dan kraan D toe en draai kraan E oop, en as daar stoom uitkom, is dit 'n bewys dat kraan B en die passaat deur die boonste toebehore en peilglas onbelas is. As geen stoom of water uitkom nie, beteken dit dat kraan B of die passaat deur die boonste toebehore en peilglas verstopt is en dat die peilglas nie behoorlik kan werk voordat die hindernis verwyder is nie.

Tweedens.—Draai kraan B toe en draai kraan D en E oop, en as daar water uitkom, is kraan D onbelas. As daar geen water of stoom uitkom nie, beteken dit dat kraan D of die passaat van die ketel af deur die laer toebehore verstopt is en skoongemaak moet word voordat die peilglas behoorlik kan werk.

MET BETREKKING SLEGS TOT FIGUUR 2.

In hierdie geval is die peilglaskraan vasgeheg aan 'n gebuigde pyp met 'n betreklike groot deursnee (en 'n boring van minstens drie duim) waarvan die boonste gedeelte verbind is met die stoomruim en die onderste gedeelte met die waterruim van die ketel. Weens die feit dat die boring van die pyp groot is, is dit onwaarskynlik dat dit verstopt sal raak of uit aksie sal raak onder die gewone werktostande. Die waterpeilglas is derhalwe in feitlik dieselfde toestand asof dit regstreeks aan die ketel vasgeheg is soos in figuur 1. Wanneer hierdie peilglas in werking is, word dit getoets presies op dieselfde wyse as die een wat in figuur 1 aangetoon word.

Skrœfproppe word by P.P. en Q.Q. ingevoeg, en deur hulle te verwyder, kan die openinge in die pyp skoongemaak word, indien nodig, deur 'n draad of stok daarin te steek wanneer die stoom laag is.

MET BETREKKING SLEGS TOT FIGUUR 3.

In hierdie peilglas is daar 'n oop verbinding van A tot C deur die kolom Y, en ten einde „deur die glas te blaas” is dit slegs nodig om kraan D en B alternatief toe te draai en E oop te hou. Maar, ten einde „deur die waterpeilglas te blaas”, met inbegrip van pype H en I, is dit nodig om, nadat daar deur die glas geblaas is soos hierby beskryf, A en C alternatief toe te draai, terwyl B, D en E terselfdertyd lank genoeg oopgehou word om te verseker dat die inhoud van die peilglas en sy verbindings heeltemal ontlaaie word. Wanneer B, D en C onbelas is en A verstopt is, kondenseer die stoom wat opgesluit raak in die glas en in die pyp I wat van kolom Y tot A lei, en die water wat deur C stroom om die plek daarvan in te neem, styg in kolom Y en in die glas tot 'n vlak bo dié van die water in die ketel. Met ander woorde, die peilglas toon 'n valse vlak aan. As E nou oopgedraai word en die water uitgeblaas word, sal die water in die peilglas, wanneer E weer toegedraai word, hoër styg as voorheen en nog verder misleidend wees. Daarenteen, wanneer B, D en A onbelas en C verstopt is, is die water, indien enige, in die glas vasgekeer en styg en daal dit nie meer saam met die water in die ketel of met die beweging van die vaartuig nie. Dit styg egter stadig in die glas weens die kondensering van die stoom in die boonste gedeelte van die waterpeilglas totdat E oopgedraai word, wanneer al die water in die glas uitgeblaas word; en wanneer E toegedraai word, toon die glas geen water nie, ondanks die feit dat die water in die ketel op die behoorlike vlak mag wees. Wanneer die toetskraan T.T.T. aan kolom Y vasgeheg word, soos in figuur 3 aangetoon, hou hulle op om betroubaar te wees wanneer kraan A of C of die pyp wat hulle verbind, verstopt of byna verstopt is. Gevolglik is dit wenslik dat sulke toetskrane regstreeks aan die ketel vasgeheg word en nie aan die kolom soos aangetoon nie.

MET BETREKKING SLEGS TOT FIGUUR 4.

Soms word die waterpeilglastoebere ingesig soos in figure 4 en 5 aangetoon, met geen passaat in die kolom op nie en met die sentrale gedeelte (N) van die kolom slegs as 'n pilaar of verbindingstuk van enige gerieflike afdeling tussen die boonste en onderste gedeeltes waaraan die kraan B en D vasgeheg is.

Deur middel van hierdie inrigting word dubbele verbindings uitgeskakel en is daar geen noodsaaklikheid vir wat „dubbele afsluiting” by die toetsing van die akkuraatheid van die peilglas genoem word nie. Wanneer die peilglase egter op hierdie wyse gebou is, is die kraan B en D onbetroubaar as toetskrane vir geval daar nie glas in die peilglas is nie. Op hierdie eienskap moet daar sorgvuldig gelet word. Bowendien, wanneer hy behoorlik funksioneer, veroorsaak die vermindering van die drukking in die glas, wat ontstaan wanneer E oopgedraai word, dat die water in pyp H bo sy normale vlak styg. Op hierdie ongewenste eienskap behoort daar ook gelet te word.

MET BETREKKING SLEGS TOT FIGUUR 5.

Soms is daarin buiging, L, in die stoompyp I wat van kraan A na kraan B lei. Wanneer nuwe ketels aan boord van 'n skip aangebring is, het dit af en toe die aandag ontgaan. In die meeste gevalle word hierdie buiging veroorsaak deurdat die pyp in 'n abnormale rigting gelei word om nie aan ander pype, balke of monterings naby die rookkas te raak nie. Met so 'n buiging vergader die gekondenseerde stoom in die pyp en daal tot op die bodem van die pyp, en met die loop van tyd vul dit die pyp geheel-en-al van I tot K. Die stoom van K af tot by die vlak van die water in die glas word sodoende vasgekeer en, namate kondensering voortgaan, lei dit tot 'n vermindering van drukking in die pyp onderkant dié van die ketel en tot 'n gelyke styging van die water in die buiging en ook in die waterpeilglas. Wanneer die vaartuig stillê, styg die water in die waterpeilglas totdat kraan E oopgedraai word of totdat die drukking in die ketel soveel hoër is as dié in die onderste deel van pyp I dat die water in die buiging as gevolg daarvan in die peilglas ingeblaas word. In albei gevalle veroorsaak dit 'n oombliklike verandering van die watervlak in die glas.

In die gewone loop van die werk word die verskynsel wat hierbo beskryf is min of meer gewysig deur die teenwoordigheid van lug in die boonste gedeelte van die waterpeilglas en deur die styging en daling van die water in die ketel en peilglas wat veroorsaak word deur die rol- of stambewegings van die vaartuig.

(u) The attention required for the operation and maintenance of the various parts of machinery. The use and management of valves, pipes, connections and safety devices employed.

(v) Enumeration and description of defects arising from working of machinery. The remedy for such defects.

(w) Constructional details and management of auxiliary steam boilers, their fittings and mountings, with special reference to water-gauges and safety valves. Constructional details and management of auxiliary machinery.

CANDIDATE FOR A CHIEF ENGINEER-OFFICER'S CERTIFICATE AND AN ENDORSEMENT OF SUCH A CERTIFICATE.

(x) The administrative duties of a Chief Engineer-Officer: organisation of his staff for emergency duties and the use of safety equipment; organisation of repairs and surveys. Reports to owners. The maintenance and working condition of machinery and appliances placed in the charge of a Senior Engineer-Officer. The attention required to prevent breakdowns and defects. The usual repairs and renewals required; supervision and inspection of machinery and boilers on board ship. Preparation of boilers and machinery for survey.

(y) The recognition of irregularity in the running of engines from indicator diagrams. The rectification of these irregularities. Illustration by means of sketches of the change produced in the diagram due to an alteration in the setting or working of the valves or any other factors.

ORAL EXAMINATION.

The oral examination will be largely based upon the Practical Knowledge subjects of the examination and will include questions on the management of engines and boilers at sea, the duties of the supervising engineer, the work to be done to engines, boilers and auxiliary machinery in port and the periodical examination of the working parts.

Candidates should also be well acquainted with machinery and boiler casualties which may occur at sea and be able to state how these may be prevented and remedied.

ANNEX. D.

READING THE WATER-GAUGE.

Notwithstanding that the reading of the water-gauge is made a special feature in the examination of Engineer-Officers, many boiler casualties result from the Engineer-Officer of the watch either not understanding the construction of the water-gauge fittings or not satisfying himself by actual trial that the cocks, pipes, etc., are clear.

Unless a candidate under examination is able to prove that he understands how to verify the indications of the water-gauge, he will not be passed in practical knowledge. Failure in practical knowledge involves a candidate going to sea for further experience before re-examination.

The sketches, Figures 1; 2, 3, 4 and 5, Plate I, represent the usual methods of attaching water-gauge mountings to marine boilers, the smoke boxes being omitted, for convenience, from Figures 3, 4 and 5. The important features in each gauge and the method of verifying its indications are dealt with separately in the following notes.

REFERRING TO FIGURE 1 ONLY.

In this case the water-gauge cocks are attached direct to the boiler, and the accuracy of the gauge when the boiler is under steam can be tested as follows:—

First.—Let B remain open, then close cock D and open cock E, and if steam issues it proves that cock B and the passage through the top fitting and gauge glass are clear. If no steam or water issues, either cock B or the passage through the top fitting and gauge glass is choked and the gauge cannot act properly until the obstruction is removed.

Second.—Close cock B and open D and E, and if water issues, cock D is clear. If no water or steam issues, either cock D or the passage from the boiler through the lower fitting is choked and must be cleared before the gauge can act properly.

REFERRING TO FIGURE 2 ONLY.

In this case the gauge cocks are attached to a bent pipe of comparatively large diameter (at least 3 inches in the bore), the upper end of which communicates with the steam space, and the lower end with the water space of the boiler. Owing to the bore of the pipe being large, it is not likely to become choked or stopped under the ordinary conditions of working. The water-gauge is, therefore, in practically the same condition as if it were attached direct to the boiler, as in Figure 1. This gauge, when at work, is tested in precisely the same manner as the one shown in Figure 1.

Screw plugs are inserted at P.P. and Q.Q., by the removal of which the apertures in the pipe can be cleared, if necessary, by the insertion of a wire or rod when steam is down.

REFERRING TO FIGURE 3 ONLY.

In this gauge there is an open communication from A to C through the column Y, and in order to "blow through the glass" it is only necessary to shut cocks D and B alternately, keeping E open. But to "blow through the water-gauge", including the pipes H and I, it is necessary, after blowing through the glass as described above to shut A and C alternately, at the same time keeping B, D and E open for such time as will ensure the complete discharge of the contents of the gauge and its connections. When B, D and C are clear and A choked, the steam lodging in the glass and in the pipe I leading from column Y to A becomes condensed and the water flowing through C to take its place rises in column Y and in the glass to a level above that of the water in the boiler. In other words, the gauge shows a false level. If now E be opened and water is blown out, then on E being again closed the water in the gauge will rise higher than before and be still further misleading. On the other hand, when B, D and A are clear and C choked, the water, if any, in the glass is trapped and no longer rises and falls with the water in the boiler or with the motion of the vessel; it, however, slowly rises in the glass owing to the condensation of the steam in the upper part of the gauge until such time as E is opened, when the whole of the water in the glass is blown out; and on E being closed, the glass does not show any water, notwithstanding that the water in the boiler may be at the proper level. When the test cocks T.T.T. are attached to column Y, as shown in Figure 3, they cease to be reliable when either cock A or C or the pipe in connection therewith is choked, or nearly choked: hence it is desirable that such test cocks should be fitted direct to the boiler and not to the column as shown.

REFERRING TO FIGURE 4 ONLY.

Sometimes the water-gauge fittings are arranged as shown in Figures 4 and 5, with no passage up the column, the central portion (N) of the column being simply a pillar or connecting piece of any convenient section between the upper and lower portions to which the cocks B and D are attached.

By this arrangement double communications are obviated and there is no need for what is known as "double shut off" in testing the accuracy of the gauge. When, however, the gauges are constructed in this manner, the cocks B and D are unreliable as test cocks in the event of there being no glass in the gauge. This feature should be carefully noted. Moreover, when in working condition, the reduction of pressure in the glass which arises when E is opened causes the water in pipe H to rise above its normal level. This objectionable feature should also be noted.

REFERRING TO FIGURE 5 ONLY.

Sometimes there is a bend, L, in the steam pipe I leading from cock A to cock B. This has occasionally escaped observation when new boilers have been fitted on board ship. In most cases this bend arises from the pipe being led in an abnormal direction to escape other pipes, beams or fittings near the smokebox. With such a bend the condensed steam collects in the pipe and falls to the bottom of the bend, and in time it completely fills the pipe from J to K. The steam from K down to the level of the water in the glass is thereby trapped and, as condensation proceeds, leads to a reduction of pressure in the pipe below that of the boiler and an equivalent rise of the water in the bend and also in the gauge glass. When the vessel is quiescent the water in the gauge glass increases in height until cock E is opened or until the pressure in the boiler is so much in excess of that in the lower part of pipe I as to cause the water in the bend to be blown into the gauge glass. In either case instantaneous change of water level in the glass ensues.

In the ordinary course of working, the phenomenon described above is more or less modified by the presence of air in the upper part of the gauge and by the rise and fall of the water in the boiler and gauge glass arising from the rolling or pitching motions of the vessel.

ANDER SPESIALE PUNTE WAAROP GELET MOET WORD.

Wanneer krane A en C weggelaat word, soos in figuur 2, is dit omdat die boring van die standpyp groot genoeg is om dit moontlik te maak om dit as deel van die ketel te beskouw. Dit is egter noodsaaklik dat sulke pype by tussenposes ondersoek en skoongemaak moet word deur 'n stok deur die gate te druk wat vir dié doel by P.P. en Q.Q. aangebring is.

Krane by A en C is nie nodig vir die toetsing van peilglase wat ingerig is soos in figure 4 en 5 aangetoon nie. Kandidate moet egter terdeë daarvan bewus wees dat dit onmoontlik is om die betroubaarheid te toets van die aanduidings van waterpeilglase wat ingerig is soos in figuur 3 wanneer krane A en C ontbreek, en ook van die uitwerking wat die verstopping van kraan A of C, of pyp H of I, het op die aanduidings van die toetskrane T.T.T. wanneer hulle aan kolom Y vasgeheg is.

Baie drywende skepe is toegerus met waterpeilglase soos in figure 3 en 4 aangetoon, en dit is derhalwe veral belangrik dat ingenieur-kandidate deeglik op die hoogte moet wees van die bou van dergelike peilglase, die beginsel waarvolgens hulle werk en die stappe wat gedoen moet word om hulle in doeltreffende toestand te hou.

Wanneer 'n waterpeilglas in sy plek gemonteer word, is dit veral belangrik dat dit nie so hoog aangebring word dat 'n skoonmaakstok nie by G, figure 1, 2, 3, 4 en 5, ingevoeg kan word nie. Hierdie gebrek, veral as dit voorkom by 'n waterpeilglas wat vasgeheg is aan 'n ketel wat opkook, laat toe dat skuim vinnig vergader om die boonste gedeelte van die glas en veroorsaak die verstopping van die opening wat van kraan B na die waterpeilglas in elk van die figure lei.

As 'n waterpeilglas te kort is of te hoog of te laag in die monterings geplaas word, bestaan daar ook die moontlikheid dat dit verstopt sal raak deurdat die pakkingsmateriaal opgestoor word oor sy eindgedeeltes deur die drukstukke terwyl dit toegeskröef word.

Die gebruik van ongeskikte of onveilige binnepype in verband met die gewone waterglaskrane van die beskrywing in figuur 1 aangetoon, of met toetskrane wat aan die ketel self vasgelas is, behoort ook sorgvuldig vermy te word.

Ongevalle by die ketels is ook veroorsaak deurdat die onderdele van krane B en D verkeerd aangebring is, soos in figuur 6, Plaat II, aangetoon. In een geval van daardie soort wat die onderwerp uitmaak van verslag No. 208 kragtens die wet op stoomketelontploffings van die Verenigde Koninkryk, het die ingenieur wat die waterpeilglas getoets het, nie toegesien dat die passate in die krane B en D onbelas was toe die handvatsels in hul behoorlike werkposisie was nie. Hierdie gebrek kon maklik opgemerk gewees het as behoorlike aandag bestee was aan die toestand van die krane. 'n Gebrek van hierdie aard mag daaraan te wyte wees dat die peilglas aanvanklik gebrekkig gebou was of aan die feit dat die handvatsels van die kraan te styf toegedraai en die nek gedraai was. Of die passate in die proppe reg en onbelas is, kan egter binne 'n paar minute geverifieer word. By wyse van toeligting kan die waterkraan D, figuur 6, Plaat II, geverifieer word deur deur E te blaas met B toegedraai en deur dan die handvat van D na een kant te skuif totdat dit net toe is en dan na die ander kant toe totdat dit weer net toe is; die behoorlike werkposisie van die handvat is ongeveer ewe ver van elk van bostaande posisies. Die ander kraan kan op dieselfde wyse geverifieer word.

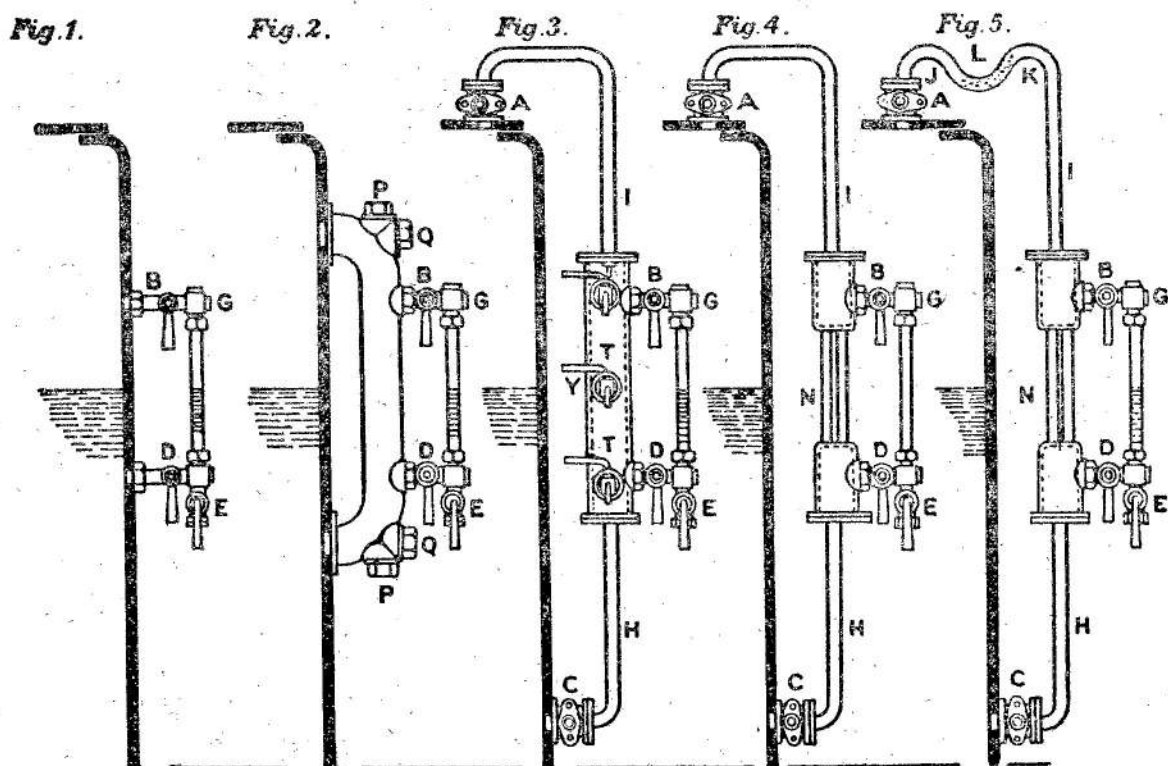
Nog 'n ernstige ongeval het plaasgevind deurdat die handvat van die kraan A, figuur 3, uit sy oorspronklike posisie relatief tot die opening van die kraan gedraai was en dit het daartoe gelei dat die kraan toe was wanneer dit gelyk het of dit oop was.

Wanneer daar deeglik geblaas is deur die waterpeilglas met al sy dele onbelas, styg die water in die glas bo die vlak waarop dit voorheen gestaan het onmiddellik nadat die aftapkraan E toegedraai is, maar as dit vir 'n tyd lank onversteurd gelaat word, daal dit geleidelik na sy vorige posisie. Die mate waarin die water by sulke geleenthede styg, hang hoofsaaklik af van die temperatuur van die inhoud van die ketel en van die lengte van die pype waarmee kolom Y bo en onder met die ketel verbind is, maar in gevalle waar die waterpeilglas ooreenstem met die beskrywing wat in figure 3, 4 en 5 toegelig is, is die styging in ketels van hoër drukking ongeveer vier duim, terwyl dit van 30 tot 40 minute duur voordat die water tot sy vorige vlak terugkeer. Die oorsaak van hierdie styging is tweeledig, naamlik, (a) die verskuiwing van die betreklike koue water in die pyp H deur warmer en, na verhouding, ligter water uit die ketel, en, (b) 'n effense kondensering van die stoom en 'n ooreenstemmende gedeeltelike vermindering van drukking in pyp I. Die oorsaak van die geleidelike daling van die water in die glas tot sy vorige vlak is ook van tweeledige aard, naamlik (a) die afkoeling van die water in pyp H, en (b) die vermindering in die kondensering van stoom in pyp I weens die versameling daarin van lug wat van die gekondenseerde stoom vrygestel word.

Hierdie resultate sal egter ietwat gewysig word indien die water in die ketel van 'n hoër digtheid is as in pyp H, en dit sal byna altyd die geval wees weens die kondensering van die stoom in die glas en boonste monterings van die waterpeilglas, wat veroorsaak dat die water in die onderste deel varser is as in die ketel.

Kandidate behoort te begryp dat dit noodsaaklik is dat daar periodiek op stelselmatige en deeglike wyse deur die waterpeilglas aan elke ketel (wat die vorm ook al mag wees) geblaas word, en in gevalle waar 'n ketel met twee waterpeilglase toegerus is, dat albei voortdurend in gebruik gehou moet word. Ten slotte moet hulle besef dat dit noodsaaklik is dat die waterpeilglase goed belig, skoon en in alle opsigte doeltreffend gehou moet word.

PLAAT I.



OTHER SPECIAL POINTS TO BE NOTED.

When cocks A and C are omitted, as in Figure 2, this is owing to the bore of the stand pipe being sufficiently large to enable it to be regarded as part of the boiler. Such pipes require, however, to be examined and cleared at intervals by passing a rod through the holes provided for the purpose at P.P. and Q.Q.

Cocks at A and C are not necessary for the testing of gauges arranged as shown in Figures 4 and 5. Candidates, however, should be fully aware of the impossibility of testing the reliability of the indications of water-gauges arranged as in Figure 3 when the cocks A and C are absent, and of the effect which the choking of cock A or C, or pipe H or I, has on the indications of the test cocks T.T.T. when attached to column Y.

Many ships afloat are fitted with water-gauges as shown in Figures 3 and 4, and it is therefore specially important that engineer candidates should thoroughly understand their construction, the principle on which they act, and the steps which must be taken to keep them in an efficient condition.

When fitting a gauge glass into its place, it is specially important that it should not be placed so high as to prevent a clearing rod being inserted at G, Figures 1, 2, 3, 4 and 5. This defect, especially if it occurs in a water-gauge attached to a boiler subject to priming permits a rapid accumulation of scum around the top of the glass and results in the choking of the orifice leading from cock B to the gauge glass in each of the figures.

When a gauge glass is too short, or is placed either too high or too low in the fittings, it is also liable to become choked by the packing material being forced over its ends by the glands whilst being screwed up.

The use of unsuitable or insecure internal pipes in connection either with the ordinary glass gauge cocks of the description shown in Figure 1, or with test cocks which are jointed to the boiler itself, should also be carefully guarded against.

Boiler casualties have resulted from the cocks B and D having the parts wrongly placed as shown in Figure 6, Plate II. In one case of that kind, which forms the subject of Report No. 208 under the Boiler Explosions Acts of the United Kingdom, the engineer in testing the water-gauge omitted to see that the passages in the cocks B and D were clear when the handles were in their proper working position. This defect could easily have been discovered if proper attention had been paid to the condition of the cocks. A defect of this nature may be due to faulty construction originally, or to the handle of the cock having been overtrained, and the neck twisted. Whether the passages in the plugs are fair and clear can, however, be verified in a few minutes. As an illustration, the water cock D, Figure 6, Plate II, can be verified by blowing through E with B shut and then moving the handle of D to one side until it is just closed, and then to the other side until it is again just closed; the proper working position of the handle is about equally distant from each of the above positions. The other cocks can be verified in the same manner.

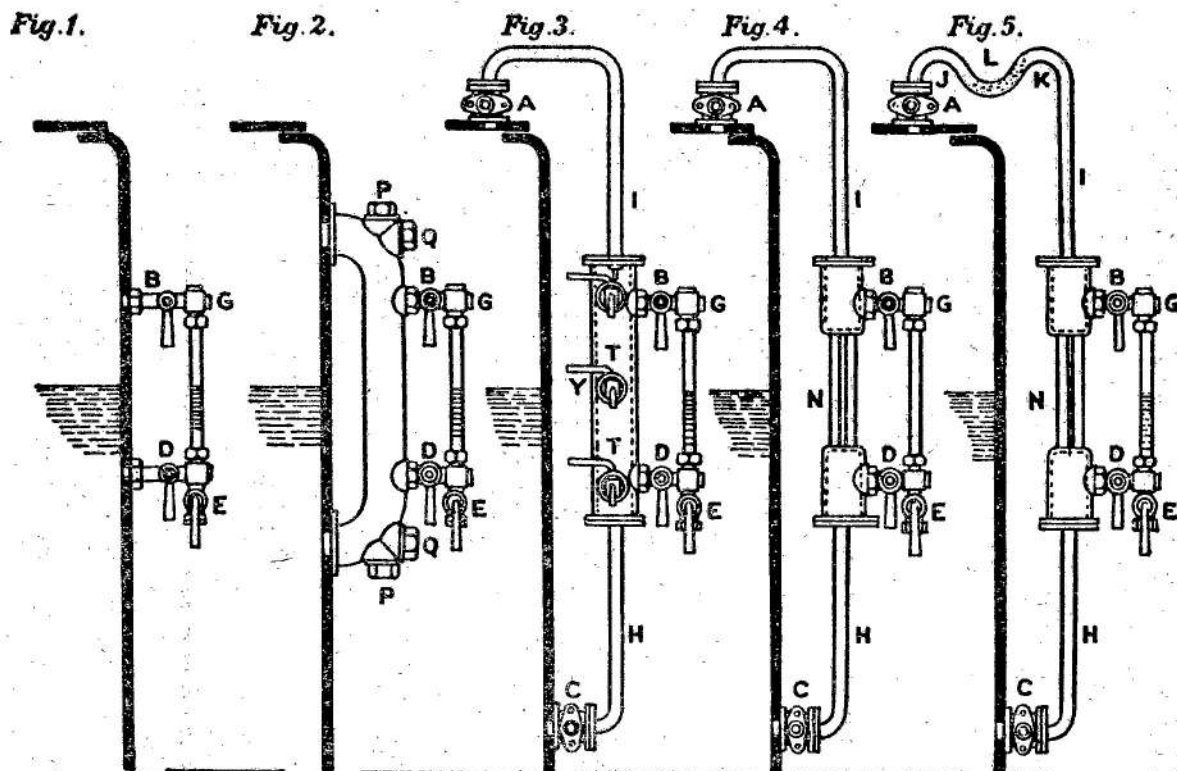
Another serious casualty occurred through the handle of the cock A, Figure 3, having been twisted from its original position relatively to the orifice of the cock, resulting in the cock being shut when apparently open.

When a water-gauge, that is clear in all its parts, has been thoroughly blown through, the water in the glass rises above the level at which it formerly stood, immediately the drain cock E is closed, but if left undisturbed for a time it gradually falls to its former position. The amount of rise which occurs on these occasions depends chiefly on the temperature of the contents of the boiler and on the length of the pipes by which column Y is connected top and bottom to the boiler, but in cases where the gauge is of the description illustrated in Figures 3, 4 and 5, it amounts in high pressure boilers to about 4 inches, while the time occupied by the water in returning to its former level ranges from 30 to 40 minutes. The cause of this rise is twofold, namely, (a) the displacement of the comparatively cold water in the pipe H by hotter and proportionately lighter water from the boiler and (b) a slight condensation of the steam and a corresponding fractional reduction of pressure in pipe I. The cause of the gradual subsidence of the water in the glass to its former level is also of a dual character, namely, (a) the cooling of the water in pipe H, and (b) the diminution in the condensation of steam in pipe I owing to the collection therein of air released from the steam condensed.

These results will, however, be somewhat modified if the water in the boiler is of higher density than in pipe H, and this will nearly always be the case owing to the condensation of the steam in the glass and upper fittings of the water-gauge, causing the water in the lower part to be fresher than that in the boiler.

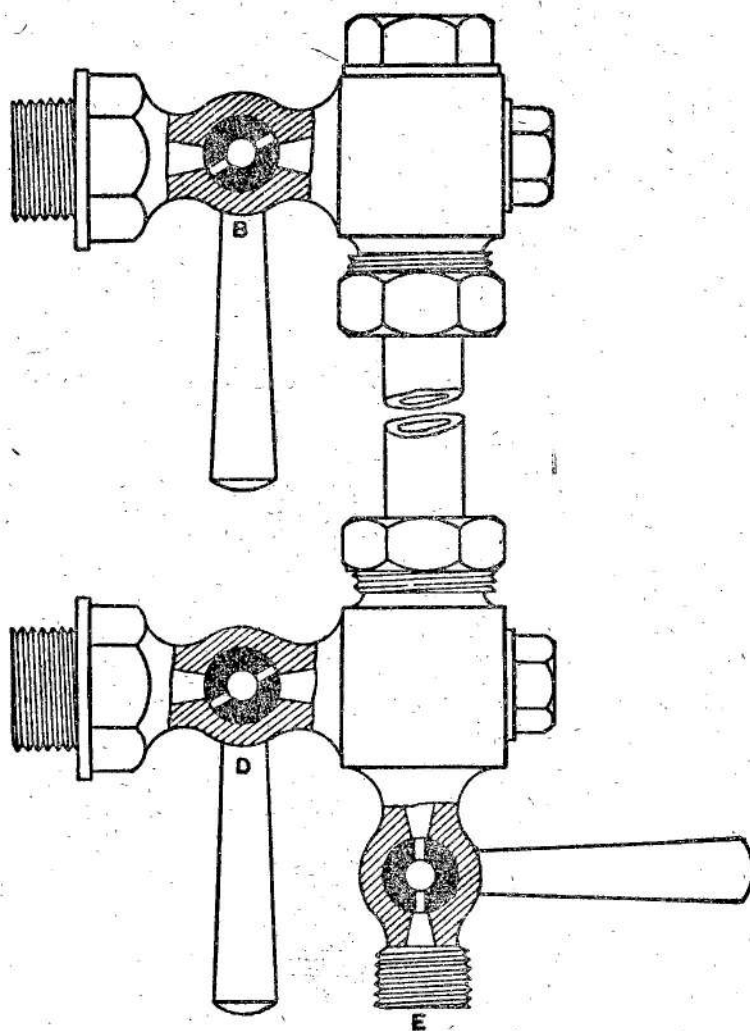
Candidates should understand the necessity for periodically blowing through the water-gauge on each boiler (no matter what the form may be) in a systematic and thorough manner, and in cases where a boiler is fitted with two water-gauges, of keeping both in constant use; finally, they should realize the necessity for keeping the water-gauges well-lighted, clean, and in all respects efficient.

PLATE I.



PLAAT II.

Fig. 6.



BYLAE E.

LYS VAN VOORGESTELDE HANDBOEKE.

Dit is moeilik om kandidate vir bekwaamheidsertifikate as hoof- en tweede ingenieuroffisiere raad te gee in verband met geskikte handboeke wat hulle by hul studies kan gebruik. Kandidate word aangeraai om die hoofde van hul plaaslike tegniese kolleges of tegniese skole te raadpleeg oor die keuse van handboeke wat handel oor die onderwerpe in Bylae C vermeld. Onderstaande lys, waaruit 'n geskikte keuse gemaak kan word, is egter omvattend genoeg om voorbereiding vir die Ekstra-eersteklaseertikaat ook in te sluit en word vir die leiding van aspirantkandidate by hierdie regulasies ingesluit.

(LET WEL.—Die pryse word aangegee bloot as leidraad vir kandidate. Hulle behoort vas te stel wat die heersende pryse is voordat hulle enige van hierdie publikasies bestel.)

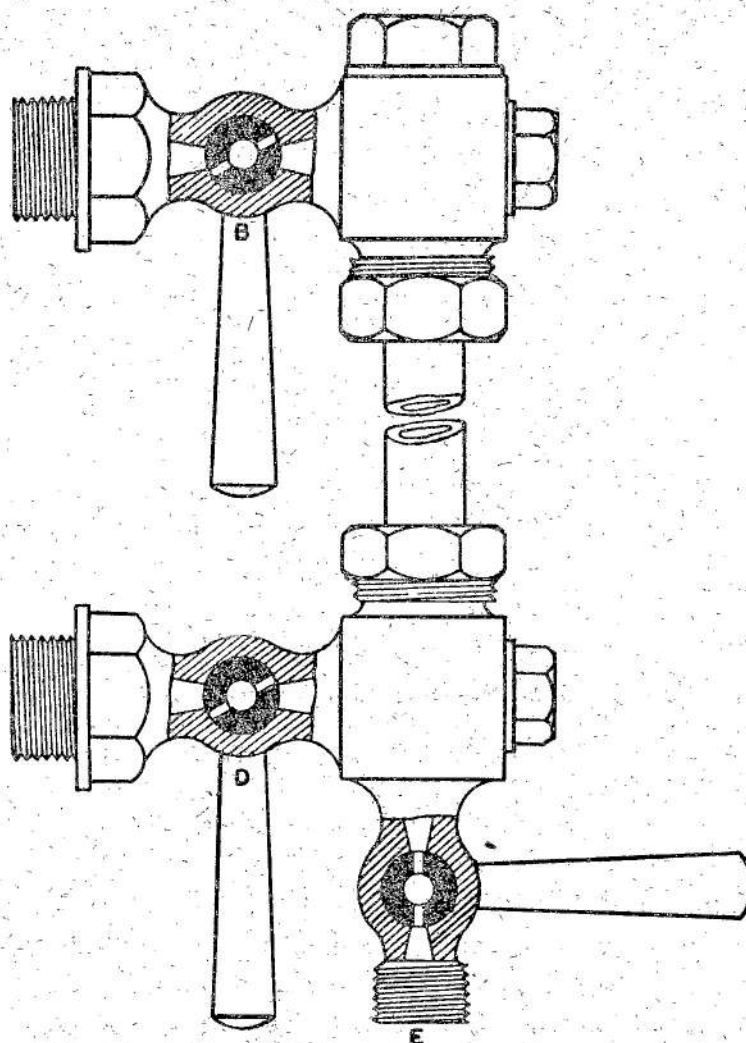
Titel.	Skrywer.	Uitgewer.
Mathematics, 15s.....	B. B. Low.....	Longmans, Green & Co., Ltd.
Mathematics for Engineers, Vol. 1, 12s. 6d.; Vol. 2, 15s.....	W. N. Rose.....	Chapman & Hall, Ltd.
Applied Mechanics, 15s.....	D. A. Low.....	Longmans, Green & Co., Ltd.
Mechanics Applied to Engineering: Vol. 1, 21s.; Vol. 2, 18s.....	J. Goodman.....	Longmans, Green & Co., Ltd.
Inchley's Theory of Heat Engines, 16s.....	H. Wright Baker.....	Longmans, Green & Co., Ltd.
The Theory and Practice of Heat Engines, 25s.....	R. H. Grundy.....	Longmans, Green & Co., Ltd.
Machine Drawing and Design, 7s. 6d.....	W. Abbott.....	Blackie & Sons, Ltd.
Engineering Drawing and Design: Vol. 1, 7s. 6d.; Vol. 2, 5s.....	S. H. Wells.....	Charles Griffin & Co., Ltd.
Elementary Electrical Engineering, 9s. 6d.....	Clayton and Shelley.....	Longmans, Green & Co., Ltd.
Electrical Technology, 15s.....	H. Cotton.....	Sir Isaac Pitman & Sons, Ltd.
Theoretical Naval Architecture, 21s.....	E. L. Attwood.....	Longmans, Green & Co., Ltd.
Merchant Ship Construction, 21s.....	H. J. Pursey.....	Brown, Son & Ferguson, Ltd.
Strength of Materials, 21s.....	A. Morley.....	Longmans, Green & Co., Ltd.
Theory of Machines, 15s.....	Toft & Kersey.....	Sir Isaac Pitman & Sons, Ltd.
Hydraulics, 15s.....	E. H. Lewitt.....	Sir Isaac Pitman & Sons, Ltd.
Metallurgy for Engineers, 10s. 6d.....	E. C. Rollason.....	Edward Arnold & Co.
Steam Turbine Operation, 15s.....	W. J. Kearton.....	Sir Isaac Pitman & Sons, Ltd.
Marine Diesel Oil Engines, Vol. 1, 30s.; Vol. 2, 30s.....	J. W. M. Sothern.....	Jas. Munro & Co., Ltd.
The Running and Maintenance of Marine Machinery, 12s. 6d.....	J. W. M. Sothern.....	Inst. of Marine Engineers.
Naval Architecture and Ship Construction, 10s.....	R. S. Hogg.....	Inst. of Marine Engineers.
Electricity Applied to Marine Engineering, 12s. 6d.....	W. Laws.....	Inst. of Marine Engineers.
The Running and Maintenance of the Marine Diesel Engine, 30s.....	J. Lamb.....	C. Griffin & Co.
Question and Answers on the Construction and Operation of Diesel, semi-Diesel, and other Internal Combustion Engines.....	J. Lamb.....	C. Griffin & Co.
The Operation of Motorship Auxiliary Machinery (2 Vols.), 40s.....	J. Lamb.....	C. Griffin & Co.

Kandidate word aangeraai om tegniese tydskrifte en die Transaksies van hul professionele inrigtings te lees. Onderstaande sirkulêres, ens., wat uitgereik word deur die Marine-afdeling van die Ministerie van Vervoer van die Verenigde Koninkryk, kan ook met voordeel gelees word:—

- Kennisgewing M. 106 (Hersien 1946): Fires in Steamship Bunker and Cargo Coal—Spontaneous Combustion.
 Kennisgewing M. 355: Prevention of Fire in Cargo Ships using Oil Fuel.
 Kennisgewing M. 415: Fires in Ships.

PLATE II.

Fig. 6.



ANNEX. E.

LIST OF SUGGESTED TEXT BOOKS.

It is difficult to advise candidates for certificates of competency as Chief and Second Engineer-Officers regarding suitable text books from which they should study. Candidates are advised to consult the Principals of their local Technical Colleges or Schools regarding the choice of text books which will deal with the subjects mentioned in Annex. C. The list given below, from which a suitable choice may be made, is however, sufficiently comprehensive to include preparation for the Extra First Class Certificate also and is included in these regulations for the guidance of intending candidates.

(NOTE.—The prices are shown merely as a guide to candidates who should ascertain the current prices before ordering any publication.)

Title.	Author.	Publisher.
Mathematics, 15s.....	B. B. Low.....	Longmans, Green & Co., Ltd.
Mathematics for Engineers, Vol. 1, 12s. 6d.; Vol. 2, 15s.....	W. N. Rose.....	Chapman & Hall, Ltd.
Applied Mechanics, 15s.....	D. A. Low.....	Longmans, Green & Co., Ltd.
Mechanics Applied to Engineering: Vol. 1, 21s.; Vol. 2, 18s.....	J. Goodman.....	Longmans, Green & Co., Ltd.
Inchley's Theory of Heat Engines, 16s.....	H. Wright Baker.....	Longmans, Green & Co., Ltd.
The Theory and Practice of Heat Engines, 25s.....	R. H. Grundy.....	Longmans, Green & Co., Ltd.
Machine Drawing and Design, 7s. 6d.....	W. Abbott.....	Blackie & Sons, Ltd.
Engineering Drawing and Design: Vol. 1, 7s. 6d.; Vol. 2, 5s.....	S. H. Wells.....	Charles Griffin & Co., Ltd.
Elementary Electrical Engineering, 9s. 6d.....	Clayton and Shelley.....	Longmans, Green & Co., Ltd.
Electrical Technology, 15s.....	H. Cotton.....	Sir Isaac Pitman & Sons, Ltd.
Theoretical Naval Architecture, 21s.....	E. L. Attwood.....	Longmans, Green & Co., Ltd.
Merchant Ship Construction, 21s.....	H. J. Pursey.....	Brown, Son & Ferguson, Ltd.
Strength of Materials, 21s.....	A. Morley.....	Longmans, Green & Co., Ltd.
Theory of Machines, 15s.....	Toft & Kersey.....	Sir Isaac Pitman & Sons, Ltd.
Hydraulics, 15s.....	E. H. Lewitt.....	Sir Isaac Pitman & Sons, Ltd.
Metallurgy for Engineers, 10s. 6d.....	E. C. Rollason.....	Edward Arnold & Co.
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Naval Architecture and Ship Construction, 10s.....	R. S. Hogg.....	Inst. of Marine Engineers.
Electricity Applied to Marine Engineering, 12s. 6d.....	W. Laws.....	Inst. of Marine Engineers.
The Running and Maintenance of the Marine Diesel Engine, 30s.....	J. Lamb.....	C. Griffin & Co.
Question and Answers on the Construction and Operation of Diesel, semi-Diesel, and other Internal Combustion Engines.....	J. Lamb.....	C. Griffin & Co.
The Operation of Motorship Auxiliary Machinery (2 Vols.), 40s.....	J. Lamb.....	C. Griffin & Co.

Candidates are advised to read technical journals and the Transactions of their professional institutions. The following Circulars, etc., issued by the Marine Division of the United Kingdom Ministry of Transport might also be read with advantage:—

- Notice M. 106 (Revised 1946): Fires in Steamship Bunker and Cargo Coal—Spontaneous Combustion.
 Notice M. 355: Prevention of Fire in Cargo Ships using Oil Fuel.
 Notice M. 415: Fires in Ships.

BYLAE F.

VOORBEELDE VAN EKSAMENVRAESTELLE.

EKSAMEN VIR INGENIEUROFFISIERS.

TWEDE INGENIEUROFFISIER.

ELEMENTÊRE WISKUNDE.

Beantwoord NET ses vrae.

(Tyd toegelaat: 3 uur.)

1. Bepaal die gewig van 'n gietysterpyp 11 voet lank en met 'n uitwendige en inwendige deursnit van onderskeidelik 12.1 dm. en 10.25 dm. Die pyp is reguit en het aan elke punt 'n flens 16.7 dm. in deursnit en 1 dm. dik.

2. Vind 'n oplossing vir X in die volgende vergelykings:—

$$(a) 4X + 14 + 2(X + 1) = \frac{7(6X - 4)}{2}$$

$$(b) \frac{11X^2 - 30X + 16}{X - 2} = \frac{X^2 - X - 6}{X + 2}$$

$$(c) 2X^2 - 24X = -22.$$

3. Vereenvoudig die volgende uitdrukkings:—

$$(a) 6\sqrt{(3^3)^2}$$

$$(b) (\sqrt{3^3})^4$$

$$(c) \left[\frac{(X^2)^3}{X^3} \right]^2 \times (X)^{\frac{3}{2}}$$

$$(d) \frac{(X^2 \times X^3 \times X^4)(X + 1)}{X^{20} - X^{18}}$$

4. Bereken die volgende uitdrukkings deur middel van logaritmes, en toon aan alle werk:

$$(a) \frac{6.524 \times 10.01 \times 0.00697 \times 100.1 \times 1.722}{6959 \times 0.0007 \times 16.1}$$

$$(b) \left[\frac{3\sqrt{0.69^2 \times 1.95}}{(2.503)^{2.44}} \right]^{\frac{1}{3}}$$

5. (a) Bewys vanaf eerste beginsels dat $\cos^2 \theta = 1 - \sin^2 \theta$.

(b) As $X = 2 \cos \theta$ en $y = 5 \sin \theta$, bepaal die waarde van θ wanneer $\frac{X^2}{2} = \frac{2y^2}{25} + \frac{3}{2}$

(c) Los die volgende vergelyking op om θ te verkry vir waardes tussen 0° en 360° $3 - 2 \sin^2 \theta - 3 \cos \theta = 0$.

6. Gestel dat $1 - \left[\frac{V_1}{V_2} \right]^{1-\gamma} = 0.55$.

$$P_1 V_1^\gamma = P_2 V_2^\gamma,$$

en $P_1 = 210$, $V_1 = 2.5$, $V_2 = 10$. Bepaal P_2 .

7. Bewys dat die bene van 'n driehoek eweredig is met die sinusse van die oorstaande hoeke. Met aanwending van hierdie eienskap van 'n driehoek, bepaal die been AB van 'n driehoek ABC waar $\angle BAC = 40^\circ$, $\angle BCA = 60^\circ$ en been BC = 3 dm.

8. Bereken $\sqrt{\cos 31^\circ \sin 12^\circ} + (\log_{10} 151)^{1.8}$

9. Trek 'n reguit streep deur die volgende twee punte en bepaal vandaar die vergelyking na die streep:—
(-2, 13) en (3, -12).

TWEDE INGENIEUROFFISIER.

TOEGEPASTE MEGANIKA.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae.

(Tyd toegelaat: 3 uur.)

1. Toon dat die lighoogte van 'n klep een-kwart van sy deursnit behoort te wees en stel 'n formule op in sy eenvoudigste vorm wat die maksimum-gewig sal aangee van soetwater wat per minuut stroom deur 'n ringventiel met 'n deursnit van D duim, wanneer die snelheid van die water V voet/sek. is. Pas die formule toe om die maksimum-gewig te bepaal van water wat deur 'n terugslagklep met 'n deursnit van 3.5 duim kan stroom teen 'n snelheid van 15 voet per sekonde.

2. 'n Sekere oliemasjien het 'n slaglengte van 1,040, mm., en wanneer die kruk deur 'n hoek van 45 grade gedraai het vanaf sy boonste dooiepunt, is die koppel op die as by hierdie posisie weens die suierbelasting 8,234 kg.m. Die lengte van die suierstang is 1,960 mm. Bereken die belasting, in pond, op die leiblok wanneer die masjien in hierdie posisie is.

3. Verduidelik die uitdrukkings *eganiese voordeel*, *snelheidsverhouding*, en *rendement*, en stel 'n formule op waardeur hulle verbind word. In 'n differensiaal-takefblok is die deursnit van die grootste katrol 13 persent meer as die van die kleinste een. Watter gewig kan opgelig word deur 'n trek van 60 lb. as die verlies deur wrywing 69 persent behoort?

4. Wanneer 'n eenvormige balk AB vanaf 'n punt 4.5 voet van A af geswaai word, moet 'n gewig van 80 lb. by A gehang word om die balk horisontaal op te lig. Wanneer dit 4.8 voet van dieselfde punt af geswaai word, is 'n gewig van 60 lb. by A nou voldoende om die balk in 'n horisontale posisie te hou.

Bepaal die gewig en die lengte van die balk.

5. Stowwe met 'n soortlike gewig van 6, 7 en 8 word gemeng in die verhouding van onderskeidelik 2, 3 en 4.

Bepaal die soortlike gewig van die mengsel wanneer die verhoudings wat aangegee word (a) volgens gewig, en (b) volgens volume is.

6. 'n Houtkubus waarvan die sye 3-voet hoog is, word in 'n kubieke tenk geplaas wat soutwater bevat. Die sye van die tenk is 4-voet hoog. Aanvanklik was die diepte van die water in die tenk 2.75 voet. As die soortlike gewig van die hout 0.75 is, bepaal die totale belasting (a) op die bodem van die tenk en (b) op elke sy van die tenk wanneer die hout vryelik in die water dryf.

ANNEX F.

SPECIMEN EXAMINATION PAPERS.

EXAMINATION OF ENGINEER-OFFICERS.

SECOND ENGINEER-OFFICER.

ELEMENTARY MATHEMATICS.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours).

1. Determine the weight of a cast iron pipe 11 ft. in length and of external and internal diameters 12.1 in. and 10.25 in. respectively. The pipe is straight and has a flange at each end 16.7 in. in diameter and 1 in. thick.

2. Solve for X in the following equations:—

$$(a) 4X + 14 + 2(X + 1) = \frac{7(6X - 4)}{2}$$

$$(b) \frac{11X^2 - 30X + 16}{X - 2} = \frac{X^2 - X - 6}{X + 2}$$

$$(c) 2X^2 - 24X = -22.$$

3. Simplify the following expressions:—

$$(a) 6\sqrt{(3^3)^2}$$

$$(b) (\sqrt{3})^4$$

$$(c) \left[\frac{(X^2)^3}{X^3} \right] \times (X)^{\frac{1}{2}}$$

$$(d) \frac{(X^2 \times X^3 \times X^4)(X + 1)}{X^{20} - X^{18}}$$

4. Evaluate the following expressions by logarithms, showing all working:

$$(a) \frac{6.524 \times 10.01 \times 0.00697 \times 100.1 \times 1.722}{6959 \times 0.0007 \times 16.1}$$

$$(b) \left[\frac{3\sqrt{0.69^2 \times 1.95}}{(2.503)^{2.44}} \right]^{\frac{1}{3}}$$

5. (a) Prove from first principles that $\cos^2 \theta = 1 - \sin^2 \theta$.

(b) If $X = 2 \cos \theta$ and $y = 5 \sin \theta$ find the value of θ when $\frac{X^2}{2} = \frac{2y^2}{25} + \frac{3}{2}$

(c) Solve the following equation to obtain θ for values between 0° and 360° $3 - 2 \sin^2 \theta - 3 \cos \theta = 0$.

6. Given that $1 - \left[\frac{V_1}{V_2} \right]^{Y-1} = 0.55$.

$\frac{P_1}{P_2} \frac{V_1^Y}{V_2^Y} = \frac{P_3}{P_4} \frac{V_1^Y}{V_2^Y}$
and $P_1 = 210$, $V_1 = 2.5$, $V_2 = 10$, Find P_2 .

7. Prove that the sides of a triangle are proportional to the sides of the opposite angles. Using the property of a triangle, find the side AB of a triangle ABC where $\angle BAC = 40^\circ$, $\angle BCA = 60^\circ$, and side BC = 3 in.

8. Evaluate $\sqrt{\cos 31^\circ \sin 12^\circ + (\log_{10} 151)^{-8}}$

9. Draw a straight line through the following pair of points and hence find the equation to the line:—
(-2, 13) and (3, -12).

SECOND ENGINEER-OFFICER.

APPLIED MECHANICS.

Do not deface or make any marks on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. Show that the lift of a valve should be one quarter of its diameter and construct a formula in its simplest form which will give the maximum weight of fresh water passing per minute through a mushroom-type valve of diameter D in, the water having a velocity of V ft/sec. Apply the formula to find the maximum weight of water which can pass through a check valve 3.5 in. in diameter at a velocity of 15 ft. per sec.

2. A certain oil engine has a stroke of 1,040 mm. and when the crank has turned through an angle of 45 degrees from its top dead centre the torque on the shaft at this position due to the piston load is 8,234 kg.m. The length of the connecting rod is 1,960 mm. Calculate the load, in lb, on the guide shoe when the engine is in this position.

3. Explain the terms *mechanical advantage*, *velocity ratio*, and *efficiency*, and write down a formula connecting them. In a differential pulley block the diameter of the larger pulley is 13 per cent more than that of the smaller one. What weight can be raised by a pull of 60 lb. if the loss by friction amounts to 69 per cent?

4. A uniform beam AB when slung from a point 4.5 ft. from A requires a weight of 80 lb. hung at A to bring the beam horizontal. When slung at 4.8 ft. from the same end a load of 60 lb. placed at A is now sufficient to maintain the beam in a horizontal position. Find the weight and the length of the beam.

5. Substances having specific gravities of 6, 7 and 8 are mixed in the proportion 2, 3 and 4 respectively. Find the specific gravity of the mixture if the proportions given are (a) by weight, and (b) by volume.

6. A cube of wood, having sides 3 ft. in length, is placed in a cubical tank containing sea water, the sides of which are 4 ft. in length. Initially, the depth of water in the tank was 2.75 ft. If the S.G. of the wood is 0.75 find the total load on (a) the bottom and (b) each side of the tank when the wood is floating freely in the water.

7. Die lemme van 'n sekere stadium in 'n turbine is vervaardig uit geelkoper 9 duim lank, met 'n uniforme dwarsdeursnitoppervlakte, en die swaartepunt van elkeen is 25 duim vanaf die omwentelingsas. Bereken die spanning op die wortel van 'n lem, weens middelpuntvliedende krag, wanneer die rotor teen 1,500 o.p.m. draai.

8. 'n Eenvoudige gesteunde balk 20 vt. lank dra 'n belasting van W ton op 'n afstand van 8 vt. van die een punt af en 3 ton op 'n afstand van 6 vt. van die ander punt af. Die buigmoment by die punt waarop die W-belasting rus, is 38 ton voet. Bepaal die waarde van W en teken die buigmoment- en skuifkragdiagramme.

9. Die silindriese romp van 'n lugreservoir is gebou van gewalste plate wat in die lengte vasgeklank is. Die plate is 1 duim dik en die kleinste rendement van die lasse is 84.5 persent.

Die belegplate het 'n halfronde vorm en die omtrekslasse wat hulle met die rompplate verbind, het 'n kleinste rendement van 65 persent. Die uiterste trekvasheid van die romp- en belegplate is onderskeidelik 30 en 26 ton per vierkantduim en die veiligheidsfaktor is konstant vir albei plate.

Gestel dat die effektiewe inwendige deursnit van die romp- en belegplate dieselfde is, bepaal die dikte van die halfronde plate.

TWEDE INGENIEUROFFISIER.

HITTE EN HITTEMOTORE.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae.

(Tyd toegelaat: 3 uur.)

1. Toon dat die koëffisiënt van kubieke uitsetting, binne baie klein perke, drie keer groter is as die koëffisiënt van uitsetting in die lengte.

Die temperatuur van 'n reghoekige staalblok 22 vt. lank, 8 dm. wyd en 6 vt. hoog word deur 500° Fahrenheit verhoog. Bereken die persentasie-toename in volume as veronderstel word dat die koëffisiënt van die lengte-uitsetting van staal 6.7×10^{-6} per graad Fahrenheit is.

2. Die spesifieke volume van stoom soos deur 'n empiriese vergelyking aangegee, is:—

$$v = 0.016 = \frac{0.1101 J.T.}{P} - 1.192 \left(\frac{273.1}{T} \right)^{1.9}$$

waar v = volume van 1 lb. droë of oorverhitte stoom in kubieke voet,

T = absoluut-temperatuur van stoom in grade Celsius,

P = stoomdruk in lb./vk. vt. abs.

J = Joule se ekwiwalent in vt. lb./C.H.E.

As die spesifieke volume van droë versadigde waterdamp onder 'n drukking van 240 lb./vk. dm. abs. 1.918 kub. vt. is, bereken die spesifieke volume wanneer dit met 100° C. oorverhit word (a) deur gebruik te maak van bostaande vergelyking, en (b) deur gebruik te maak van die wet van Charles.

Let wel.—Versadigingstemperatuur onder 'n druk van 240 lb./vk. dm. = 203° C.

3. In 'n Diesel-enjin het die lug by die aanvang van verdigting 'n druk en temperatuur van onderskeidelik 14 lb./vk. dm. abs. en 120° F. Aan die einde van verdigting is die druk 504 lb./vk. dm. abs. en die vryslagvolume is 120 kubieke duim. As die indeks van die wet van verdigting 1.3 is, bepaal:—

(a) die weggeveegde volume,

(b) die temperatuur aan die einde van verdigting.

4. 'n Turbine-installasie gebruik 7.6 lb. oorverhitte stoom per asperdekrag per uur en uitlating vind plaas onder 'n druk van 0.75 lb./vk. dm. abs., wanneer die stoom dan 'n droogheidsfaktor van 0.87 het.

Met gebruik van die Stoomtafels wat verskaf word, bepaal:—

(a) die volume van die uitlaatstoom wat per asperdekrag per minuut na die kondensator stroom, en

(b) die perdekrag-ekwiwalent van die hitte wat oorboord ontlai word per asperdekrag wat ontwikkel word as die temperatuur van die verdigte stoom 88° F. is.

5. Skets diagrammaties en beskryf kortliks 'n kalorimeter vir die bepaling van die hittewaarde van 'n gasagtige brandstof. 'n Monster van koolstofgas was in 'n kalorimeter getoets en die temperatuur van die water wat in- en uitgevloei het, was onderskeidelik 16° C. en 23° C. Toe 0.13 kub. vt. gas verbrand was, het 2,000 kubieke sentimeter water deur die kalorimeter gegaan. Bepaal die hittewaarde van die gas in Britse Termiese Eenhede per kub. vt. soos gebruik.

6. Die oppervlakte van 'n indikateurdiagram vanaf die silinder van 'n vierslag enkelwerkende binnebrandmasjien is 6 vk. sm. Die lengte van die diagram is 2.75 dm. en die skaal 1:360 (1 dm. = 360 lb./vk. dm.). Wat is die gemiddelde druk in kilogram per vierkant-sentimeter? As die boor en slag van die masjien onderskeidelik 720 en 1,200 mm. is en die masjien teen 115 o.p.m. draai, bepaal die gemiddelde arbeid wat verrig word per omwenteling in vt. lb. en die indikateur-perdekrag.

7. 'n Lugreservoir bevat 1,200 lb. lug onder 'n meterdruk van 350 lb./vk. dm. en by 75° F. As veronderstel word dat daar isothermiese druk is, bereken (a) die volume lug onder lugdruk en by 75° F. wat benodig word om die reservoir te vul, en (b) die deursnit van die reservoir as sy gemiddelde lengte 25 vt. is.

Let wel.—Een kub. vt. lug onder lugdruk en by 32° F. weeg 0.0807 lb.

8. Die straaltyp van 'n aksieturbine vorm 'n hoek van 20 grade met die rotasievlak, die snelheid van die stoom is 2,600 vt./sek., die lemsnelheid is 1,100 vt./sek. en die lemme is simmetries. Die stoom verlaat die lemme in 'n aksiale rigting.

Teken die snelheidsdiagram en bepaal (a) die inlaat- en uitlaathoeke van die lemme, (b) die lemwrywingskoëffisiënt, en (c) die werk wat per lb. per sekonde verrig word.

9. 'n Skip se bunker bevat 1,170 ton van 'n sekere soort kool wat stu teen 41 kub. vt. per ton, en het 'n hittewaarde van 14,700 B.T.E./lb. Dit blyk dat hierdie kool voldoende is vir 'n reis van 18 dae. Op 'n ander reis word die bunkers gevul met 'n ander soort kool wat 'n hittewaarde van 12,900 B.T.E./lb. het en gestu kan word teen 46 kub. vt. per ton. Bepaal die gewig van die kool wat oorbly in die bunkers nadat die skip 11 dae op die tweede reis gevaar het teen 'n snelheid van 2 persent groter as die van die eerste seereis.

Let wel.—Die verbruik/eenheidtyd verskil regstreeks as (snelheid)³.

7. The blades of a certain stage in a turbine are made of brass 9 in. in length, have uniform cross sectional area, and the c.g. of each is 25 in. from the axis of rotation. Calculate the stress at the root of a blade, due to centrifugal force, when the rotor is rotating at 1,500 r.p.m.

8. A simply supported beam 20 ft. long carries a load of W tons at a distance of 8 ft. from one end and 3 tons at 6 ft. from the other end. The bending moment at the point of the W load is 38 tons ft. Find the value of W and draw the bending moment and shearing force diagrams.

9. The cylindrical shell of an air reservoir is built of rolled plates riveted longitudinally, the plates are 1 in. in thickness and the least efficiency of the joints is 84.5 per cent.

The end plates are hemispherical in form and the circumferential joints, connecting them to the shell plates, have a least efficiency of 65 per cent. The ultimate tensile strength of the shell and end plates is 30 and 26 tons per sq. in. respectively and the factor of safety is constant for both plates.

Taking the effective internal diameter of the shell and end plates to be the same, determine the thickness of the hemispherical plates.

SECOND ENGINEER-OFFICER.

HEAT AND HEAT ENGINES.

Do not deface or make any marks on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. Show that the coefficient of cubical expansion is, within very small limits, equal to three times the coefficient of linear expansion.

A rectangular block of steel 22 ft. in length, 8 in. in breadth and 6 in. in depth has its temperature raised through 500 Fahrenheit degrees. Calculate the percentage increase in volume taking the coefficient of linear expansion of steel as 6.7×10^{-6} per degree F.

2. The specific volume of steam as given by an empirical equation is:—

$$v = 0.016 = \frac{0.1101 J.T.}{P} - 1.192 \left(\frac{273.1}{T} \right)^{1.9}$$

where v = volume of 1 lb. of dry or superheated steam in cu. ft.

T = absolute temperature of steam in degrees Centigrade.

P = steam pressure in lb/sq. ft. abs.

J = Joule's equivalent in ft. lb/C.H.U.

If the specific volume of dry saturated steam at a pressure of 240 lb/sq. in. abs. is 1.918 cu. ft. calculate the specific volume when superheated 100°C. (a) by using the above equation, and (b) by using Charles' Law.

Note.—Saturation temperature at 240 lb/sq. in. = 203°C.

3. In a Diesel engine, the air at the beginning of compression has a pressure and temperature of 14 lb/sq. in. abs. and 120°F, respectively. The pressure at the end of compression is 504 lb/sq. in. abs. and the clearance volume is 120 cu. in. If the index of the law of compression is 1.3, find:—

(a) the swept volume,

(b) the temperature at the end of compression.

4. A turbine installation uses 7.6 lb. of superheated steam per s.h.p. per hour and exhaust takes place at a pressure of 0.75 lb/sq. in. abs., the steam then having a dryness fraction of 0.87.

Using the Steam Tables provided, determine:—

(a) the volume of the exhaust steam passing to the condenser per s.h.p. per minute, and

(b) the horse-power equivalent of the heat discharged overboard per s.h.p. developed if the temperature of the condensate is 88°F.

5. Sketch diagrammatically and describe briefly a calorimeter for determining the calorific value of a gaseous fuel. A sample of coal gas was tested in a calorimeter and the temperature of the water entering and leaving were respectively 16°C and 23°C. When 0.13 cu. ft. of gas was burnt 2,000-cubic centimetres of water had passed through the calorimeter. Determine the calorific value of the gas in B.Th.U. per cu. ft. as used.

6. The area of an indicator diagram from the cylinder of a four-stroke single-acting internal combustion engine is 6 sq. cm. The length of the diagram is 2.75 in. and the scale 1:360 (1 in. = 360 lb/sq. in.). What is the mean pressure in kilogrammes per square centimetre? If the bore and stroke of the engine are 720 and 1,200 mm. respectively and the engine turns at 115 r.p.m., find the average work done per revolution in ft. lb. and the i.h.p.

7. An air reservoir contains 1,200 lb. of air at a gauge pressure of 350 lb/sq. in. and 75°F. Assuming isothermal compression, calculate (a) the volume of air at atmospheric pressure and at 75°F required to fill the reservoir, and (b) the diameter of the reservoir if its mean length is 25 ft.

Note.—One cu. ft. of air at atmospheric pressure and 32°F. weighs 0.0807 lb.

8. The nozzle of an impulse turbine makes an angle of 20 degrees to the plane of rotation, the speed of the steam is 2,600 ft./sec., the blade speed is 1,100 ft./sec. and the blades are symmetrical. The steam leaves the blades in an axial direction.

Draw the velocity diagram and determine (a) the inlet and outlet angles of the blades, (b) the blade friction coefficient, (c) the work done per lb. per sec.

9. A ship's bunker holds 1,170 tons of a certain kind of coal which stows at 41 cu. ft. per ton, and has a calorific value of 14,700 B.Th.U./lb. This coal proves to be sufficient for 18 days' steaming. On another voyage the bunkers are filled with a different kind of coal, having a calorific value of 12,900 B.Th.U./lb., and stowing at 46 cu. ft. per ton. Find the weight of coal remaining in the bunkers after steaming for 41 days on the second voyage at a speed 2 per cent greater than that on the first voyage.

Note.—The consumption/unit time varies directly as (speed)³.

TWEDE INGENIEUROFFISIER.

TEKENE.

ALGEMENE INSTRUKSIES.

1. Teken die voorwerp duidelik met potlood, maar voeg die maatpyltjies en syfers met ink in.
2. Werktekenings volgens skaal word vereis en nie afbeeldings nie.
3. Voeg al die mate in wat vir die konstruksie van die voorwerp in die werkplaas nodig is.
4. Mate moet in voet en duim aangegee word.
5. Moenie meer as die gespesifiseerde aantal dele teken nie.
6. Krediet sal vir korrekte projeksies gegee word.
7. Die materiaal waarvan verskillende dele gemaak moet word, moet op die tekening aangedui word.

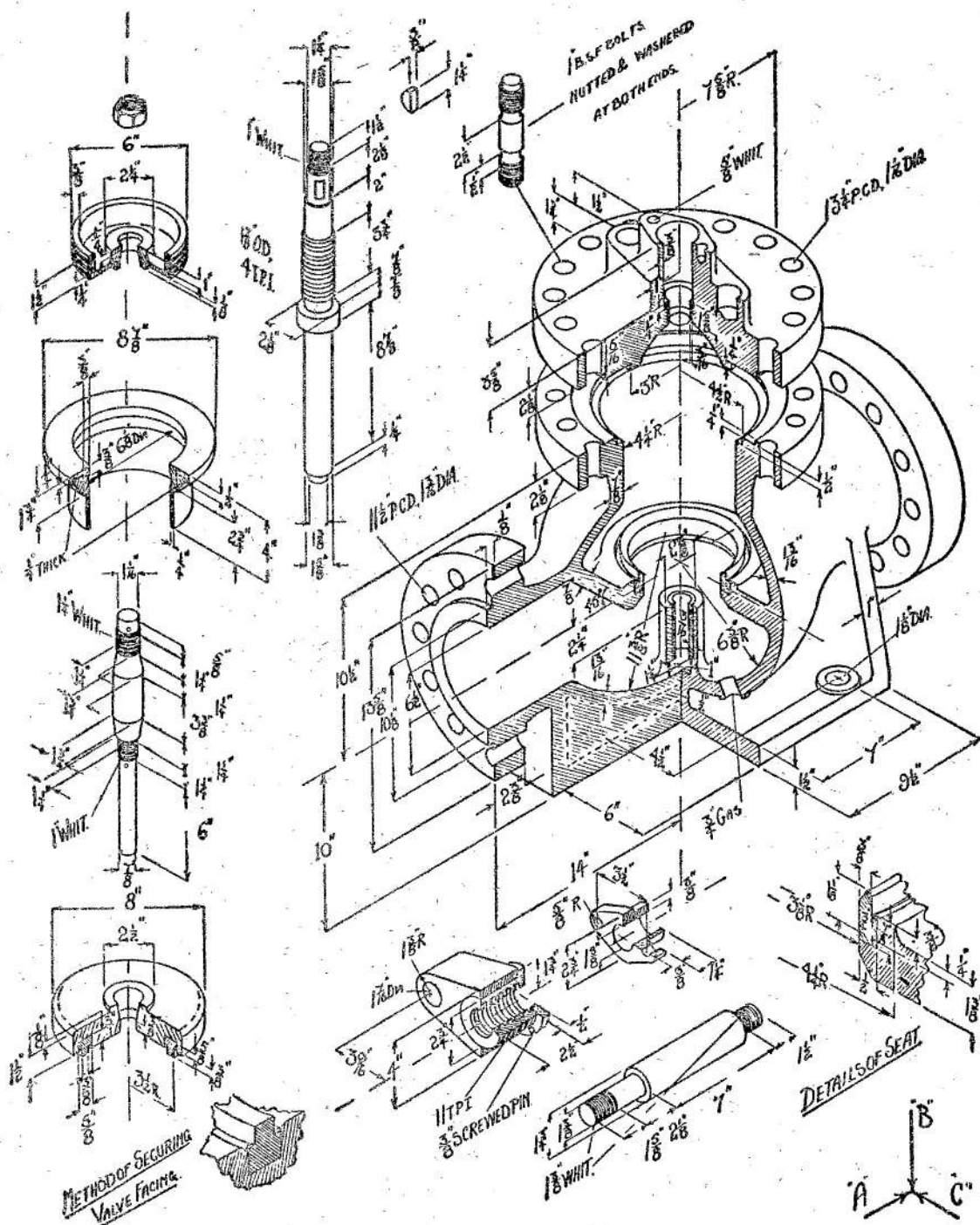
HOËDRUK GEKOMBINEERDE ISOLEER- EN-AFSLUITKLEP.

Teken die volgende aansigte met al die dele inmeekaargesit:—

- (a) 'n Vertikale aansig wat in rigting „C” wys en wat die linkershelfte in profiel deur die vertikale middellyn toon; en
(b) 'n entaansig in ten volle geprojekteerde vorm (a).

Toon die klep in geslote stand.

(Tyd toegelaat: 6 uur.)



VERKLARENDE OPMERKING.

Verkorting.	Woordbetekenis.
WHIT.....	WHITWORTH.
BSF-BOUTE.....	Britse Standaard Fyn Boute.
—	Met skroewe en wasters aan beide ente.
DIA.....	Diameter.
—	Gas.
—	Besonderhede van Bedding.

Verkorting.	Woordbetekenis.
DPD.....	Drade per duim.
—	Skroefpen.
BD.....	Buitediameter.
—	Dik.
—	Metode vir vassit van klepvoorstak.
R.....	Rad us.
SSD.....	Steeksirkeldiameter.

SECOND ENGINEER-OFFICER.

DRAWING.

GENERAL INSTRUCTIONS.

1. Draw the object clearly in pencil but insert the dimension arrowheads and figures in ink.
2. Working drawings to scale are required, and not pictorial representations.
3. Insert all the dimensions necessary for the construction of the object in the workshops.
4. Dimensions should be given in feet and inches.
5. Do not draw more parts than are specified.
6. Credit will be given for correct projection.
7. The material of which different parts are to be made should be indicated on the drawing.

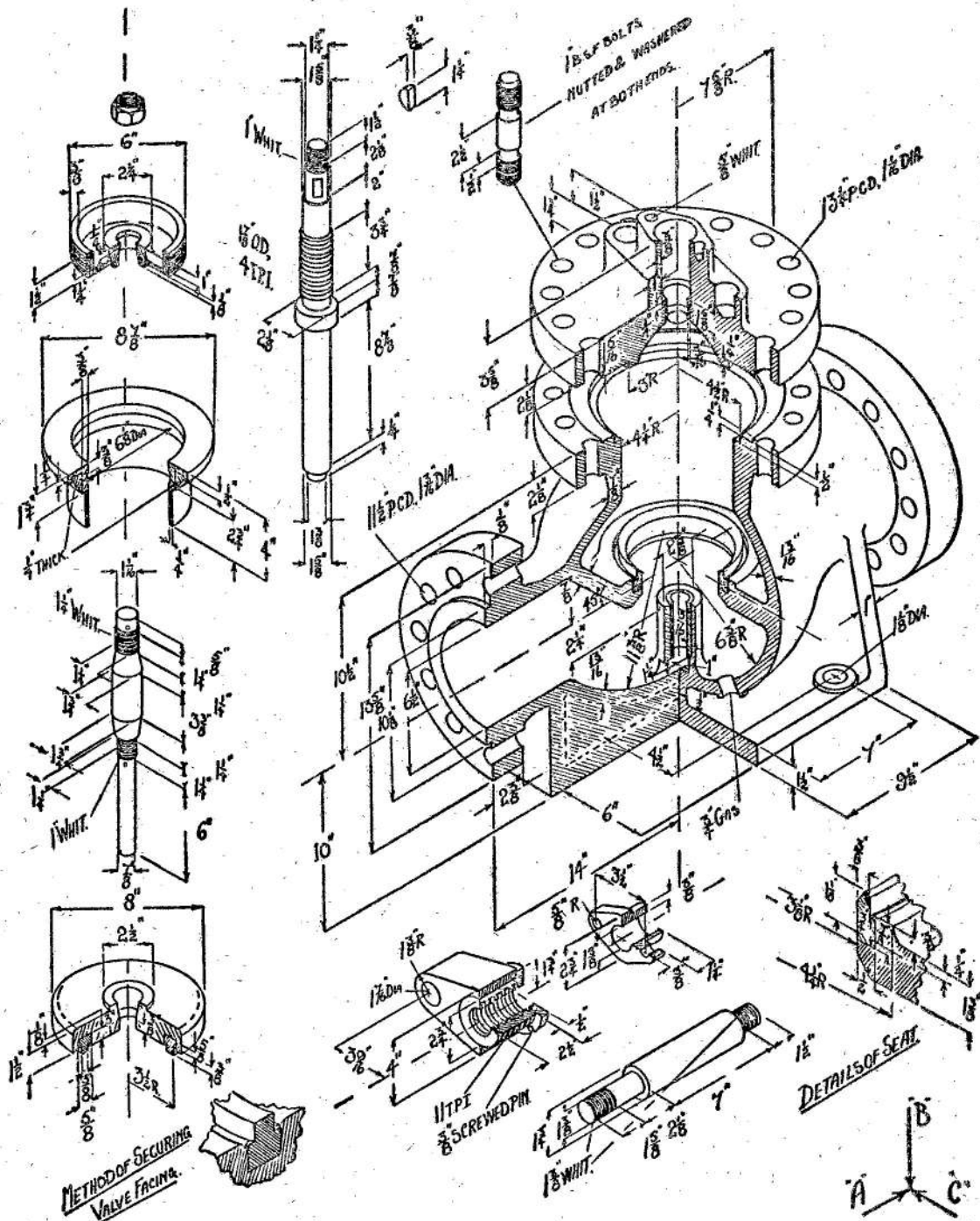
HIGH PRESSURE COMBINED ISOLATING AND STOP VALVE.

Draw the following views with all parts assembled:—

- (a) an elevation looking in direction "C" showing the left-hand half in section through the vertical centre line; and
- (b) an end elevation in full projected from (a).

Show the valve in the closed position.

(Time allowed: 6 hours.)



EXPLANATORY NOTE.

Abbreviation.	Meaning.
WHIT.....	WHITWORTH.
BSF BOLTS.....	British Standard Fine Bolts.
—	Nutted and Washered at both ends.
DIA.....	Diameter.
—	Gas.
—	Details of Seat.

Abbreviation.	Meaning.
TPI.....	Threads per Inch.
—	Screwed Pin.
OD.....	Outside Diameter.
—	Thick.
—	Method of securing Valve Facing.
R.....	Radius.
PCD.....	Pitch Circle Diameter.

TWEDE INGENIEUROFFISIER.

ELEKTROTEGNIK.

Moenie hierdie vraestel skend of enige merke hoegenaamd daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae. Een vraag uit elke afdeling moet beantwoord word en nog drie ander vrae.

(Tyd toegelaat: 3 uur.)

AFDELING A.

1. Wat word bedoel met die uitdrukking „teen E.M.K.” soos toegepas op 'n elektriese motor? 'n Newestroommotor van 220 volt en 50 remperdekrag het 'n rendement van 90 persent wanneer dit ten volle belas is, 'n ankerweerstand van 0.075 ohm en 'n newestroomveldweerstand van 55 ohms . Daar word verlang om, wanneer die aansithandvatsel by die aansit na die eerste kerf verskuif word, die stroom deur die anker te beperk tot 1.5 maal die waarde wat dit het wanneer die motor ten volle belas is. Wat moet die totale waarde van die aansitweerstand wees? As die snelheid, onder oorbelaasting, na 90 persent van sy normale vollebelastingwaardes daal, wat sal die ankerstroom wees?

2. Omskryf die temperatuurkoeffisiënt van 'n geleier se weerstand. Noem 'n geleier wat 'n negatiewe temperatuurkoeffisiënt het. Wanneer dit die eerste keer aangeskakel word, neem die veldbewikkeling van 'n newestroommotor van 200 volt 2A. Nadat die motor twee uur lank geloop het, word daar opgemerk dat die stroomveldstroom verminder het na 1.7A, maar dat die toevoerstroombelasting konstant gebly het en dat die stelling van die newestroomreguleerder nie verander is nie. As die omringende lugtemperatuur 15°C is, bereken die gemiddelde temperatuurstyging binne die bewikkelings.

3. Stel die wet van Lenz. 'n Ysterring word bewikkel met 'n spoel van 84 wikkels en word belaa met 1.5×10^{-8} weber ($1,500$ lyne) van remanente magnetisme. Wanneer die spoel opgewek word, vermeerder die magnetiese stroom tot 3×10^{-4} weber ($30,000$ lyne) in 0.12 sek . Bereken die gemiddelde waarde van die E.M.K. wat selfopgewek sal word in die opwekkingspoel terwyl die strooming toeneem, en noem die rigting waarin dit sal werk met betrekking tot die toevoerstroombelasting, en gee die redes hiervoor.

AFDELING B.

4. 'n Wisselstroombelasting met 'n effektiwe waarde van 100 volts word toegepas op 'n kragkring met onbeduidende weerstand en 'n induktiewe reaktans van 25 ohms . Bepaal die effektiwe waarde van die strooming en toon grafies die variasie van stroom en stroomspanning gedurende een siklus van die toegepaste stroomspanning. Wat is die waarde van die stroom wanneer die stroomspanning sy maksimum-waarde het?

5. Bepaal die impedans en kragfaktor van 'n W.S.-kragkring wat bestaan uit twee stukke apparaat in serie. Stuk A het 'n weerstand van 2 ohms en 'n induktiewe reaktans van 14 ohms , en stuk B het 'n weerstand van 10 ohms en 'n kapasitiewe reaktans van 6 ohms .

AFDELING C.

6. Beskryf, met behulp van 'n skets, die bou van 'n beweegbare spoelinstrument en verduidelik hoedat dit werk. Hoe word dit in die hoofkragkring geskakel as (a) 'n voltmeter, en (b) 'n ammeter?

7. Verduidelik die noodsaaklikheid van 'n vereffeningskakeling tussen generators met saamgestelde bewikkeling wat parallel geskakel word. Gee in behoorlike volgorde die stappe wat gedoen moet word sodat 'n generator met saamgestelde bewikkeling 'n soortgelyke masjien van sy belasting kan onthef.

8. Beskryf enige vorm van sekondêre sel en bespreek die werking gedurende die lading en ontlading van die sel. Skets 'n stroomloopskema van 'n installasie vir die lading van die sel vanaf die skip se hoofgeleidings en verduidelik die funksie van 'n teenstroomskakelaar.

9. Vir watter doel word aardproeflampe geïnstalleer op die hoofskakelbord van 'n skip? Teken die stroomloopskema en verduidelik breedvoerig hoedat 'n aardsluiting op enige plek in die skip opgespoor en sy posisie gelokaliseer kan word.

TWEDE INGENIEUROFFISIER.

SKEEPSONTWERP.

Moenie hierdie vraestel skend of enige merke daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae. Drie vrae in Afdeling A moet beantwoord word.

(Tyd toegelaat: 3 uur.)

AFDELING A.

1. Noem die veronderstellings wat gemaak moet word ten einde te toon dat die hoeveelheid brandstof wat daagliks verbruik word eweredig is met die kubus van die skip se snelheid.

Teen 'n snelheid van $14\frac{1}{2}$ knope verbruik 'n skip 20 ton brandstof per dag. Bepaal die maksimum-snelheid waarteen die skip kan vaar as daar slegs nog vyf ton brandstof oorbly en die skip 100 seemyl van die naaste hawe is.

2. Die aanvangsverplasing van 'n skip is $2,700 \text{ ton}$ en die swaartepunt is $25 \text{ vt. bo die kiel}$. Die volgende gewigsveranderinge vind plaas:—

- 400 ton word $12 \text{ vt. bokant die kiel}$ bygelaa;
- 300 ton word $18 \text{ vt. bokant die kiel}$ bygelaa;
- 500 ton word $27 \text{ vt. bokant die kiel}$ bygelaa;
- 200 ton word $2 \text{ vt. bokant die kiel}$ verwyder;
- 400 ton alreeds aan boord word 10 vt. ondertoe verskuif.

Bereken die eindverplasing en vertikale posisie van die swaartepunt.

3. Die verskil tussen die minimum-vryboord van 'n skip in soetwater van 'n soortlike gewig en die minimum-vryboord in soutwater word genoem die Soetwatervergunning en word aangedui deur $\frac{\Delta}{40T}$ duim, waarin

Δ = die waterverplasing in tonne;

T = tonne per duim indompeling in soutwater met 'n gewig van $1,025 \text{ ons per kub. vt.}$ by hierdie verplasing.

Met toepassing van eerste beginsels, herlei bostaande uitdrukking waarby veronderstel word dat die wateroppervlakte konstant bly tussen die betrokke diepgange.

4. Met 'n volle vag aan boord is die diepgang van 'n skip $25 \text{ vt. in soutwater}$ en die ooreenstemmende oppervlakte van die watervlak is $21,000 \text{ vk. vt.}$ Die oppervlaktes van parallelwatervlakke onderkant die vagwatervlak met tussenposes van 5 voet is onderskeidelik $19,300$, $17,200$, $14,280$ en $9,660 \text{ vk. vt.}$ As veronderstel word dat die verplasing van die gedeelte onderkant die laagste watervlak wat aangegee is 711 ton is, bereken die verplasing van die skip (a) wanneer hy met 'n diepgang van $15 \text{ vt. in soutwater}$ dryf, en (b) wanneer hy 'n volle vag aan boord het.

5. Omskryf die uitdrukking Dryfvermoënpunt en toon, met behulp van sketse, hoedat 'n skip met stabiele ewewig weer orent kom nadat 'n uitwendige faktor dit laat oorhel het.

Die swaartepunt van 'n skip met 'n verplasing van $8,000 \text{ ton}$ is $3 \text{ vt. bokant die dryfvermoënpunt}$ wanneer die skip regop is. As die moment wat neig om die skip orent te laat kom $1,900 \text{ ton/vt.}$ is wanneer die skip 7 grade oorhel, bereken hoever die dryfvermoënpunt horisontaal van sy aanvangsposisie af beweeg het.

SECOND ENGINEER-OFFICER.

ELECTROTECHNOLOGY.

Do not deface or make any marks whatever on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted. One question from each section must be attempted and any three others.

(Time allowed: 3 hours.)

SECTION A.

1. What is meant by the term "back e.m.f." as applied to an electric motor? A 50 b.h.p. 220V shunt motor has a full load efficiency of 90 per cent, an armature resistance of 0.075 ohm and a shunt field resistance of 55 ohms. It is desired to limit the current through the armature to 1.5 times the value which it has when the motor is on full load, when the starting handle is moved on to the first stud when starting. What must be the total value of the starting resistance? If, under overload, the speed falls to 90 per cent of its normal full load value what would be the armature current?

2. Define the temperature coefficient of resistance of a conductor. Name a conductor which has a negative temperature coefficient. When first switched on the field winding of a 200V shunt motor takes 2A. After running for two hours the field current is observed to have decreased to 1.7A, the supply voltage having remained constant and the setting of the shunt regulator not having been altered. If the ambient air temperature is 15°C, calculate the average temperature rise within the windings.

3. State Lenz's Law. An iron ring is wound with a coil of 84 turns and carries 1.5×10^{-3} weber (1,500 lines) of residual magnetism. When the coil is excited the magnetic flux increases to 3×10^{-4} weber (30,000 lines) in 0.12 sec. Calculate the average value of the e.m.f. which will be self-induced in the exciting coil while the flux is increasing and state the direction in which it will act relative to the supply voltage, giving reasons.

SECTION B.

4. An alternating voltage of R.M.S. value 100 volts is applied to a circuit with negligible resistance and an inductive reactance of 25 ohms. Determine the R.M.S. value of the current flowing and show graphically the variation of current and voltage during one cycle of the applied voltage. What is the value of the current when the voltage is at its maximum value?

5. Find the impedance and power factor of an A.C. circuit consisting of two pieces of apparatus in series. Piece A has a resistance of 2 ohms and an inductive reactance of 14 ohms, and piece B has a resistance of 10 ohms and a capacitive reactance of 6 ohms.

SECTION C.

6. Describe, with the aid of a sketch, the construction of a moving coil instrument and explain how it functions. How is it connected in the main circuit as (a) a voltmeter, (b) an ammeter?

7. Explain the necessity for having an equalising connection between compound-wound generators which are being run in parallel. Give in proper sequence the steps to be taken in order that a compound-wound generator may relieve a similar machine of its load.

8. Describe any form of secondary cell and discuss the action during charge and discharge. Give a circuit diagram of an arrangement for charging the cell from the ship's mains and explain the function of a reverse current switch.

9. What is the purpose of fitting earth detection lamps on the main switch board of a vessel? Draw the circuit diagram and explain in detail how an earth anywhere in the vessel may be detected and its position localized.

SECOND ENGINEER-OFFICER.

NAVAL ARCHITECTURE.

Do not deface or make any marks on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted. Three questions in Section A must be attempted.

(Time allowed: 3 hours.)

SECTION A.

1. State the assumptions which have to be made in order to show that the quantity of fuel used per day is proportional to the cube of the speed of a vessel.

A vessel uses 20 tons of fuel per day at a speed of $14\frac{1}{2}$ kt. Determine the maximum speed at which it can steam if it has only 5 tons of fuel and is 100 sea miles from the nearest port.

2. The initial displacement of a ship is 2,700 tons and the centre of gravity is 25 ft. above the keel. The following weight changes take place:—

- 400 tons added 12 ft. above keel,
- 300 tons added 18 ft. above keel,
- 500 tons added 27 ft. above keel,
- 200 tons removed 2 ft. above keel,
- 400 tons already on board moved 10 ft. downwards.

Calculate the final displacement and vertical position of the centre of gravity.

3. The difference between the minimum freeboard of a vessel in fresh water of unit density and the minimum freeboard in salt water is known as the Fresh Water Allowance and is given by $\frac{\Delta}{40T}$ inches, where

Δ = Tons displacement.

T = Tons per inch immersion in salt water of density 1.025 oz. per cu. ft. at this displacement.

From first principles derive the above expression, which assumes that the waterplane area remains constant between the draughts concerned.

4. Fully loaded, the draught of a vessel is 25 ft. in sea water and the corresponding area of waterplane is 21,000 sq. ft. The areas of parallel waterplanes below the load waterplane, at intervals of 5 ft. are 19,300, 17,200, 14,280 and 9,660 sq. ft. respectively. Assuming the displacement of the portion below the lowest given waterplane to be 711 tons, calculate the displacement of the vessel when (a) floating at a draught of 15 ft. in sea water, and (b) fully loaded.

5. Define *Centre of Buoyancy* and show, with the aid of sketches, how a vessel which has stable equilibrium will return to the upright after being heeled over by an external force.

A vessel displacing 8,000 tons has its centre of gravity 3 ft. above the centre of buoyancy when in the upright condition. If the moment tending to right the vessel is 1,900 tons ft. when the vessel is heeled over 7 degrees, calculate the horizontal distance the centre of buoyancy has moved from its initial position.

AFDELING B.

6. Skets en beskryf die verskillende soorte vloere wat gebruik word by die bou van selyvormige dubbelbodemtenks en dui aan waar elke soort gebruik word. Toon hoedat hulle vasgeheg is aan die aangrensende dele van die struktuur.

7. Verduidelik die betekenis van die volgende uitdrukkings soos toegepas op skepe:—

- | | |
|---------------|------------------------|
| (a) Dolboord, | (d) verskansingspoort, |
| (b) stringer, | (e) enjinbekleding. |
| (c) diepgang, | |

8. Skets en beskryf 'n skroefaskoker soos die wat geïnstalleer word in 'n dubbelskroefskip. Toon hoedat dit gesteun en bevestig word.

9. Toon met behulp van 'n skets wat slegs die betrokke kompartemente moet insluit, die inrigting van 'n windas en ankerkabels. Hoe word die punt van 'n kabel in die kettingbak bevestig?

Wat word bedoel met (a) kluispyp, (b) kettingleipyp, (c) kabelligter, (d) kabelstopper?

TWEDE INGENIEUROFFISIER.

INGENIEURSWESE.

OGGENDVRAESTEL.

ALLE KANDIDATE.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vroe afskryf nie.

Beantwoord NET ses vroe.

(Tyd toegelaat: 3 uur.)

1. Noem by benadering die hoeveelheid koolstof bevat in (a) gegote staal en (b) gegote yster, en noem die vorms waarin die koolstof daarin mag voorkom.

Vergelyk die fisiese eienskappe van hierdie twee metale en noem party van die belangriker dele van masjinerie waarvoor gegote staal gebruik word.

2. Skets en beskryf 'n stoomaangedrewe vrachysinrigting, en gee besonderhede van die klepwerking, koppelings en remme. Bespreek die voorkomende instandhoudingswerk van hierdie installering.

3. Watter voorsorgsmaatreëls moet getref word by tenkpininrigtings wanneer die tenks gebruik mag word vir sowel waterballas as oliebrandstof? Skets en beskryf enige veiligheidsinstallasie wat verskaf word en verduidelik hoedat dit gebruik word.

4. Beskryf 'n stelsel van meganiese skuimproduksie, soos gebruik word vir die blussing van brand in die masjienruime van 'n skip wat oliebrandstof verbruik, en verduidelik hoedat dit werk.

5. Maak lyndiagramme van (a) die soliedekolom-waterpeilglase van ketels en (b) die holkolom-waterpeilglase van ketels, en verduidelik hoedat elkeen getoets word. Toon deur middel van sketse die inrigting van die pakkingbuis aan elke punt van die peilglas.

6. Noem die opgeloste vaste stowwe in (a) soutwater en (b) soetwater, en gee 'n aanduiding van die toestande in onderskeidelik die ketels en die verdampstoestelle wat daartoe lei dat hulle neerslaan.

7. Beskryf, met behulp van 'n diagrammatiese skets, 'n koelinstallasie wat met 'n tussenvloeistofkoelingseffek werk. Noem die verkoelingsmedia wat gebruik word in die installasie en die voordele van hierdie soort stelsel.

8. Skets en beskryf enige soort kragaangedrewe stuurinrigting waarmee u bekend is. Sluit in enige noodtoebehoere wat verskaf word vir gebruik in die geval van beskadiging aan—

- (a) die telemotor,
(b) die stuurinrigting.

9. Uit watter bronne kan olie sy weg vind na die masjienruimkimmer van 'n skip? In watter omstandighede kan olieagtige water oorboord ontlai word? Beskryf die apparaat waardeur olieagtige water uit die kimmer moet gaan as dit in 'n dok of hawe ontlai moet word.

TWEDE INGENIEUROFFISIER.

INGENIEURSWESE.

MIDDAGVRAESTEL.

KANDIDATE VIR STOOMSERTIFIKATE.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vroe afskryf nie.

Beantwoord NET ses vroe.

(Tyd toegelaat: 3 uur.)

1. Gee 'n duidelike uiteensetting van wat bedoel word met die uitdrukking „uitsettingsverhouding”, soos toegepas op 'n stoomenjin. Wat bepaal die uitsettingsperk in marinepraktyk?

2. Beskryf die werk wat gedoen moet word om die bekleding van 'n groot marineturbiner oop te maak en die rotor uit te lig, en verduidelik breedvoerig hoedat die lemme teen beskadiging beskerm word. Watter verstellings is nodig wanneer die turbine toegemaak word en hoe word hulle bewerkstellig?

3. As die draagvlak van die voorste laedruk-eksentriek-ring van 'n drievoudige ekspansiestoommasjien aansienlik verslyt is, hoe sal dit die werking van die motore raak? Verduidelik hoedat hierdie defek verhelp kan word.

4. Hoe word 'n installasie van hoofstoomketels, of silindriese of waterpypketels, in 'n skip gesteun, en hoe word hulle bevestig om beweging in enige rigting te beperk? Maak 'n ruwe skets van die fundasie-inrigtings.

5. Bespreek volledig die prosedure vir die voorbereiding van 'n stel turbines met tandrat-oorbrengring om 'n skip uit 'n hawe te manuvreer, asook enige verdere stappe wat nodig is wanneer die teken „met volle krag vooruit” gegee word. Meld die soort turbinemasjinerie wat u bespreek.

6. Wat is die doel wanneer fosfate gebruik word by die behandeling van stoomketelwater? Beskryf roetine-toetse wat gevolg moet word om die hoeveelhede chemikalieë wat by voedingswater gevoeg moet word te bepaal.

7. Skets en beskryf 'n stoomskuif van die ewewigskleptipe, uitgesonderd 'n suierklep, wat geskik is vir 'n groot marinemasjien. Verduidelik hoe dit werk en noem die werkingsvryruimtes.

8. Skets en beskryf 'n oppervlakte-voedingswaterverwarmer en sy verbindings. Meld die voordele van voedingsverwarming.

9. Beskryf twee soorte kondensatorbuisverpakings en toon 'n tiperende buisinrigting vir 'n regeneratorkondensator. Dui aan die stroming van die koelwater.

SECTION B.

6. Sketch and describe the various types of floors used in the construction of cellular double-bottom tanks and indicate where each type is employed. Show how they are attached to the adjacent parts of the structure.

7. Explain the meaning of the following terms as applied to ships:—

- (a) gunwale,
(b) stringer,
(c) draught,

- (d) freeing port,
(e) engine casing.

8. Sketch and describe a stern tube as fitted to a twin screw ship. Show how it is supported and secured.

9. Show with the aid of a sketch, which should include only the compartments concerned, the arrangement of a windlass and anchor cables. How is the end of the cable secured in the chain locker?

What is meant by (a) pipe, (b) spurling pipe, (c) cable lifter, (d) cable stopper.

SECOND ENGINEER-OFFICER.

ENGINEERING KNOWLEDGE.

MORNING PAPER.

ALL CANDIDATES.

Do not deface or make any marks on this paper.

Do not copy the questions.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. State the approximate proportion of carbon contained in (a) cast steel and (b) cast iron, and mention the forms in which the carbon may occur therein.

Compare the physical properties of these two metals and name some of the more important parts of machinery for which cast steel is used.

2. Sketch and describe a steam-driven cargo winch, giving details of valve gear, clutches and brakes. Discuss the preventive maintenance which should be carried out on this installation.

3. What precautions are necessary in tank pumping arrangements when the tanks may be used for either water-ballast or oil-fuel? Sketch and describe any safety fitting provided and explain how it is used.

4. Describe a system of mechanical foam production, as used for the extinction of fire in the machinery spaces of a vessel using oil fuel, and explain how it operates.

5. Make line diagrams of (a) the solid column and (b) the hollow column types of boiler water-gauges and explain how each is tested. Show, by sketches, the arrangement of the stuffing box at each end of the gauge glass.

6. Name the dissolved solids in (a) sea water and (b) fresh water and indicate the conditions in boilers and evaporators, respectively, which would cause them to be deposited.

7. Describe, with the aid of a diagrammatic sketch, a refrigerating plant which works with an intermediate liquid cooling effect. State the refrigerating media used in the plant and the advantages of this type of system.

8. Sketch and describe any type of power-driven steering-gear with which you are familiar. Include any emergency fittings which are provided for use in the event of damage to:—

- (a) the telemotor,
(b) the steering-gear.

9. From what sources may oil find its way into the machinery space bilges of a vessel? In what circumstances may oily water be discharged overboard? Describe the apparatus through which oily bilge water should be passed if it is to be discharged into a dock or harbour.

SECOND ENGINEER-OFFICER.

ENGINEERING KNOWLEDGE.

AFTERNOON PAPER.

STEAM CANDIDATES.

Do not deface or make any marks on this paper.

Do not copy the questions.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. Explain clearly what is meant by the expression "ratio of expansion" as applied to a steam engine. What determines the limit of expansion in marine practice?

2. Describe the operation of opening up the casing and lifting the rotor of a large marine turbine, explaining in detail how the blading is protected from damage. What adjustments are required to be made on closing up the turbine and how are they effected?

3. Should the bearing surface of the ahead low-pressure eccentric strap of a triple-expansion steam engine become considerably worn, how would it affect the working of the engines? Explain how this defect might be remedied.

4. How is an installation of main boilers, either cylindrical or watertube, supported in a ship, and how are they secured to restrict movement in any direction? Make a rough sketch of the seating arrangements.

5. Discuss fully the procedure for preparing a set of geared turbines for manoeuvring out of port, also any further action necessary when "full away" is given.

State the type of turbine machinery you are discussing.

6. What is the purpose of the use of phosphates in boiler-water treatment? Describe routine tests to be followed for determining the amounts of the chemicals to be added to feed water.

7. Sketch and describe a slide valve of the balanced type, other than a piston valve, suitable for a large marine engine. Explain its action and state the working clearances.

8. Sketch and describe a surface feed-water heater and its connections. State the advantages of feed-heating.

9. Describe two types of condenser tube packing and show a typical tube arrangement for a regenerative condenser. Indicate the flow of the cooling water.

TWEDE INGENIEUROFFISIER.

INGENIEURSWESE.

MIDDAGVRAESTEL.

KANDIDATE VIR MOTORCERTIFIKATE.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vroeë afskryf nie.

Beantwoord NET ses vroeë.

(Tyd toegelaat: 3 uur.)

1. Skets en beskryf 'n tweestadiumlugpersomp en toon aan watter veiligheidstoestelle geïnstalleer is. Bespreek breedvoerig die prosedure van aansit en die roetine-aandag wat vereis word gedurende die loop van 'n onafhanklike aangedrewe lugkompressor.

2. Beskryf 'n suierverkoelingsinrigting vir 'n groot Dieselenjin, en gee detailskette van die drukstukke wat geïnstalleer is. Watter oorwegings geld vir die punt waar dit nodig word om hierdie apparaat in die ontwerp van die enjin in te lyf? Noem die koelingsmedia wat gewoonlik gebruik word en bespreek hul betreklike verdienstes.

3. Beskryf die werk wat gedoen moet word om die suier van 'n groot Dieselenjin vir nasien en herstel te verwyder en die aard van die ondersoek wat uitgevoer word. Bespreek die verstellings wat nodig mag wees voordat die suier teruggesit word.

4. Gee 'n duidelike uiteensetting van die wyse waarop die volgende defekte in die loop van 'n Dieselenjin nagespoor en verhelp kan word:—

- (a) Lekkasje in die suierringe, (c) vroeë ontsteking,
(b) nabranding, (d) gedeeltelik verstopte brandstofklep.

5. Skets en beskryf die suierstang-olieskraapverpakking wat geïnstalleer is in die krukasdiafragma van groot Dieselenjins, en toon aan die oliedreineringsstelsel. Verduidelik hoedat die verpakking gewysig word.

6. Bespreek die volgende items in verband met die silindervoering van 'n Dieselenjin:—

- (a) Normale slytasietempo,
(b) posisie en rigting waarin die grootste slytasie in die voering voorkom;
(c) maksimum-slytasie wat toegelaat word voordat die voering vervang word.

Gee u sienswyse oor die hoeveelheid silindersmeerolie wat gebruik moet word onder normale volladingstoestande, en noem die grootte van die enjin en die tipe enjin.

7. Bespreek die wysigings wat nodig is aan die brandstofstelsels van Dieselenjins om hulle in staat te stel om olie van hoë viscositeit te gebruik. Verduidelik die rede vir elke wysiging.

8. Skets en beskryf 'n roterende aanblaasinrigting soos die wat gebruik word om 'n groot marinemasjien van reinigingslug te voorsien, en verduidelik hoe dit werk. Vergelyk die stelsels van luslynreininging en gelykstroomreininging.

9. Teken 'n diagrammatiese skets van 'n uitlaatgasstoomketel van die vingerhoedbuistipe en beskryf die bou en werking daarvan.

HOOF-INGENIEUROFFISIER.

TOEGEPASTE MEGANIKA—A I.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vroeë afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vroeë.

(Tyd toegelaat: 3 uur.)

1. 'n Turbinerotor met 'n gewig van 3.54 ton, moet op 'n skip opgetrek word deur 'n hyskraan wat gebruik maak van 'n draagband bestaande uit twee kettings van gelyke lengte wat aan die hyskraanhaak hang. Elke ketting kan 'n wag van 2.5 ton met veiligheid dra.

Daar kan beskou word dat die rotor bestaan uit dele A, B, C en D, van links na regs gesien, met die betreklike verhoudings soos volg:—

	Lengte.	Deursnit.
A.....	3.0	0.5
B.....	2.0	2.0
C.....	1.0	3.0
D.....	1.5	1.5

Bepaal die betreklike posisie, gemeet vanaf die regterhandse punt van die rotor, bokant welke die hyskraanhaak die wag moet optel en die toelaatbare maksimum-hoek tussen die kettings.

2. Die drukkopverskil tussen die ingang en die hals van 'n venturimeter is 2.2 duim kwiksilwer wanneer 420 gellings soetwater per minuut ontlai word. As dit bekend is dat die boordeursnit 12 duim is, wat moet die deursnit van die hals wees?

Die meter lê met sy as op die horisontale vlak; daar kan aanvaar word dat daar geen verliese as gevolg van wrywing is nie.

3. Die boonste punte van twee vertikale drade, een van staal en een van geelkoper, en albei van dieselfde lengte, is stewig bevestig 3 vt. uitmekaar; hul onderste ente is aan 'n horisontale staaf vasgeheg.

As die deursnit van die geelkoperdraad twee maal groter is as die van die staaldraad, op watter posisie aan die horisontale staaf moet 'n gewig gehang word sodat die staaf horisontaal sal bly?

Let wel.—Vergelyking vir Geelkoper = 15×10^6 lb./vk. dm. Vergelyking vir Staal = 30×10^6 lb./vk. dm.

4. 'n Klepkontrollestang 28 dm. lank, word vervaardig uit 'n staalpyp wat 18 duim lank is en wat 'n inwendige en uitwendige deursnit van onderskeidelik $1\frac{1}{2}$ dm. en $1\frac{1}{4}$ dm. het, en 'n fosforbrons-as 12 duim lank en met 'n deursnit van 1 duim. 'n Tweeduiimlange gedeelte van die brons-as word in die pyp ingestee en met hardsoldering bevestig. Wanneer 'n sekere momentkoppel op die stang toegepas word, word 'n maksimum-afskuiwspanning van 3,000 lb./dm.² in die pyp geïnduseer. Bepaal hierdie momentkoppel en ook die maksimum-afskuiwspanning in die brons-as. Sonder inagneming van die baie klein draaiingshoek wat by die aansluiting voorkom, bepaal die totale draaiingshoek in die stang. Gebruik C vir staal = 12×10^6 lb./dm.² en C vir fosforbrons = 6×10^6 lb./dm.².

Let wel.— $\frac{T}{J} = \frac{q}{r} = \frac{C\theta}{L}$ waar J vir 'n soliede as = $\frac{\pi r^4}{2}$.

SECOND ENGINEER-OFFICER.

ENGINEERING KNOWLEDGE.

AFTERNOON PAPER.

MOTOR CANDIDATES.

Do not deface or make any marks on this paper.

Do not copy the questions.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. Sketch and describe a two-stage air compressor, showing the safety devices fitted. Discuss in detail the procedure of starting and the routine attention required during the running of an independently-driven compressor.
2. Describe a piston cooling arrangement for a large Diesel engine, giving detail sketches of the glands fitted. What considerations govern the point where it becomes necessary to incorporate this apparatus in the design of the engine? State the cooling media usually employed and discuss their relative merits.
3. Describe the operation of removing the piston of a large Diesel engine for overhaul and the nature of the examination made. Discuss the adjustments which may be necessary before replacing the piston.
4. Explain, clearly, how the following defects in the running of a Diesel engine would be detected and remedied:—
 - (a) leaking piston rings,
 - (b) afterburning,
 - (c) early firing,
 - (d) partially choked fuel valve.
5. Sketch and describe the piston rod oil scraper packing fitted in the crankcase diaphragm of large Diesel engines, showing the oil draining arrangement. Explain how the packing is adjusted.
6. Discuss the following items in connection with a Diesel engine cylinder liner:—
 - (a) normal rate of wear,
 - (b) position and direction of greatest wear in the liner,
 - (c) maximum wear allowed before replacement.
 Give an opinion as to the amount of cylinder lubricating oil which should be used under normal full load conditions, stating the size and type of engine.
7. Discuss the modifications required on the fuel systems of Diesel engines to enable them to use oils of high viscosity. Explain the reason for each modification.
8. Sketch and describe a rotary blower, as used to supply scavenge air to a large marine engine and explain its action. Compare the systems of loop and uniflow scavenging.
9. Make a diagrammatic sketch of an exhaust gas boiler of the thimble tube type and describe its construction and operation.

CHIEF ENGINEER-OFFICER.

APPLIED MECHANICS—A I.

Do not deface or make any marks on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. A turbine rotor, which has a weight of 3.54 tons, is to be hoisted aboard ship by a crane using a sling consisting of two chains of equal length suspended from the crane hook. Each chain is capable of carrying a load of 2.5 tons with safety.

The rotor may be considered to be made up of parts A, B, C and D, viewed from left to right, with the relative proportions as follows:—

	Length.	Diameter.
A.....	3.0	0.5
B.....	2.0	2.0
C.....	1.0	3.0
D.....	1.5	1.5

Determine the relative position, measured from the right hand end of the rotor, above which the crane hook should pick up the load and the maximum permissible angle between the chains.

2. The pressure head difference between the entrance and throat of a venturi-meter is 2.2 in. of mercury when discharging 420 gall. of fresh water per minute. If it is known that the full bore diameter is 12 in., what must be the throat diameter? The meter lies with its axis in the horizontal plane; you may assume that there are no frictional losses.

3. Two vertical wires, one of steel and one of brass and of equal lengths, have their upper ends rigidly fixed 3 ft. apart; their lower ends being attached to a horizontal bar.

If the diameter of the brass wire is twice that of the steel, at what position on the horizontal bar must a weight be hung so that the bar remains horizontal.

Note.—E for Brass = 15×10^6 lb/sq. in. E for Steel = 30×10^6 lb/sq. in.

4. A valve control spindle, 28 in. in length, is made from an 18 inch length of steel tube, $1\frac{1}{4}$ in. and $1\frac{1}{2}$ in. internal and external diameters, respectively, and a 12 inch length of phosphor bronze shaft, $1\frac{1}{4}$ in. diameter. A 2 inch length of the bronze shaft is let into the tube and secured by brazing. When a certain torque is applied to the spindle the maximum shear stress induced in the tube is $3,000$ lb/in². Find this torque and also the maximum shear stress in the bronze shaft. Neglecting the very small angle of twist which occurs at the junction, find the total angle of twist in the spindle. Take C for steel = 12×10^6 lb/in.² and C for phosphor bronze = 6×10^6 lb/in.².

Note.— $\frac{T}{J} = \frac{q}{r} = \frac{C\theta}{L}$ where J for a solid shaft = $\frac{\pi r^4}{2}$

5. Die deursnit van 'n nok is sodanig dat dit 'n eenvoudige harmoniese beweging gee aan die drukstuk van sowel die heengaande as die teruggaande slag. Die slag van die drukstuk is 4 duim en die slaglyn gaan deur die middel van die nokas. As die snelheid van die nokas 300 o.p.m. is en die drukstuk vanaf die begin van sy slag $\frac{1}{2}$ duim beweeg het, bepaal die snelheid en versnelling van die drukstuk. As die drukstuk en sy bevestigings 4 lb. weeg, bepaal die kinetiese energie van die drukstuk vir bostaande posisie.

6. 'n Skyf lê in 'n horisontale vlak en is vry om te roteer; 'n massa word op die skryf geplaas 18 duim vanaf die roterende as. As die wrywingskoeffisiënt tussen die skyf en die massa 0.4 is, bepaal (a) die maksimum-snelheid in o.p.m., en (b) die maksimum-versnelling in uitstraling/sek./sek. wat aan die skyf gegee kan word sonder dat die massa gly.

7. Die windingspompspoel van 'n windas het, met inagneming van die dikte van die draad, 'n effektiewe deursnit van 2 vt. Die spoel, tesame met die as, kamwiel, ens., weeg 600 lb. en die traagheidsstraal van die samestelling is 10 dm. Bereken die spanning in die draad en die dryfmomentkoppel benodig wanneer die windas 'n vrag van 5 cwt. oplig met 'n versnelling van 0.5 vt./sek./sek.

8. Die dryfrat van 'n middelpuntvliedende pomp is 2 vt. 6 dm. in buitendeursnit en loop teen 100 o.p.m. As die water die lemme verlaat met 'n straalvormige snelheid van 5 vt./sek. en 'n tangensiale snelheid van 5 vt./sek. in rotasierigting, bereken die hoek van die lem by uitlaat, met betrekking tot die tangens, wat sal toelaat dat die water die lem sonder skok verlaat.

9. Die vier ringe van die rompplaat van 'n lugreservoir, met 'n binnendeursnit van 5 vt. 3 dm., is $1\frac{1}{4}$ dm. dik. Die plate word skuins gesny en met stuiklasse gesweis sodat die stuikswelasse spiraalvormige hoeke van 45 grade vorm met die omtrekslas wat ook gesweis word. As die werkdruk 400 lb./vk. dm. is, wat is die normale trekspanning by (a) die omtreksweilas en (b) die skuins sweilas?

HOOF-INGENIEUROFFISIER.

HITTE EN HITTEMOTORE—A II.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae.

(Tyd toegelaat: 3 uur.)

1. 'n Skip het drie stoomketels elk 17 voet in deursnit en 13 voet lank, en, voordat hitte-isolasiemateriaal op die stoomketels toegepas is, was die temperatuur van hul buite-oppervlakte 350° F., terwyl die temperatuur van die stookruim 100° F. was. Nadat die stoomketels egter geïsoleer is, was die temperatuur op die oppervlakte van die isolasie 150° F. en die temperatuur van die stookruim was 90° F. As die kool wat gebruik is 'n hittewaarde van 12,500 B.T.E. per lb. gehad het, bereken die hoeveelheid ton per dag wat op hierdie wyse gespaar word, as veronderstel word dat albei ente van elke stoomketel benewens die rompplaat geïsoleer was.

Let wel.—Die hoeveelheid hitte Q wat uitgestraal word van 'n oppervlakte met 'n absoluut-temperatuur van T (°F) word aangedui deur $Q = k T^4$ B.T.E./vk. vt./uur, waar $k = 16 \times 10^{-10}$.

2. In 'n dubbeleffekverdampinstallasie word uitlaattroom onder 'n druk van 37 lb./vk. dm. abs. en 0.9 droëstroom voorsien aan die eerste verdampspoel en verlaat die dreineerbuis as water by 200° F.

Die droë waterdamp uit hierdie verdampstoestel word gelei na die spoel van die tweede verdampstoestel onder 'n druk van 20 lb./vk. dm. abs. en verlaat die dreineerbuis as water by 170° F. Die waterdamp van die tweede verdampstoestel is droë versadigde waterdamp onder 'n druk van 7 lb./vk. dm. abs. en rou water by 80° F. word gevoer aan die romp van albei verdampstoestelle.

Bereken die totale gewig van die rou water wat uit albei verdampstoestelle verdamp word vir een pond van die oorspronklike uitlaattroom.

3. Stoom onder 'n druk van 40 lb./vk. dm. abs. en droë versadigde waterdamp gaan deur 'n konvergerende straalpyp met 'n uitlaattoepervlakte van 3.5 vk. dm. tot 'n einddruk van 25 lb./vk. dm. abs. met 'n droogheidsfaktor van 0.98. Bereken die gewig van die stoom wat per minuut onttrek word.

4. By die vervaardiging van loodpype word die soliede warm loodstaaf gelei deur 'n ringvormige snyyster onder 'n druk van 1,390 Kg/vk. sm. op 'n dampelaar wat in die silinder werk waarin die lood bevat is. As die gedane arbeid aan die lood deur dit deur die snyyster te forseer in hitte omgeskep word, bepaal in grade Celsius die temperatuurstyging van die lood wanneer dit deur die snyyster gaan.

5. As gevolg van kondensatorbuislekkasie is die gewig van vaste stowwe in die water van die warmwaterbak, per eenheidsvolume, 0.25 die gewig van die soutwater en word dit noodsaaklik gevind om oor te gaan tot die aanhoudende afspui van die ketel wat die droë versadigde waterdamp ontwikkel onder 'n druk van 240 lb./vk. dm. abs. uit voeding by 120° F. As die brandstofverbruik as gevolg van die lekkasie met 3.8 persent vermeerder het, bepaal, met behulp van die Stoomtafels wat verskaf word, die digtheid van die ketelwater, gestel dat die samestelling van die vaste stowwe in soutwater soos volg is:—

Sodiumkloried.....	3.52 ons/gelling.
Magnesiumkloried.....	0.45 ons/gelling.
Magnesiumsulfaat.....	0.32 ons/gelling.
Kalsiumsulfaat.....	0.16 ons/gelling.
Kalsiumkarbonaat.....	0.04 ons/gelling.

6. 'n Viervoudige ekspansiemasjien neem stoom op onder 'n druk van 225 lb./vk. dm. abs. en laat stoom uit onder 'n druk van 2 lb./vk. dm. abs. Die silindervolume is in die verhouding van 1:2.08:4:327:9. Die totale aantal ekspansies is 14 en die afsluiting in beide die eerste en tweede A.D.-silinders is 0.62, terwyl die afsluiting in die L.D.-silinders 0.75 is.

As veronderstel word dat die stoom deur die hele enjin uitsit volgens die wet $PV = C$ en sonder inagneming van vryslagspeling en alle verliese, bepaal (a) die absolute druk by die afsluiting in elke silinder, en (b) die verhouding van die vier suierbelastings gedurende toelating van die stoom.

7. 'n Ses-silinder enkelwerkende petrolienjin werk op die vierslagsiklus en die silinderboor en slag is onderskeidelik 3.5 en 4.5 dm. Die brandstof wat gebruik word, bevat 84 persent koolstof en 16 persent waterstof volgens gewig. Wanneer die enjin teen 3,000 o.p.m. loop, is die volumetriese rendement by 32° F. en onder 'n druk van 14.7 lb./vk. dm. abs. 0.76. Bereken die brandstofverbruik in lb./uur as die enjin werk met 'n lug-brandstofverhouding vir chemies korrekte verbranding. Gebruik R vir die mengsel as 51.2. Lug bevat 23 persent suurstof volgens gewig, die atomiese gewig van waterstof, koolstof en suurstof is onderskeidelik 1, 12 en 16.

8. 'n Enjin wat op die ideale Dieselsiklus werk, word voorsien van lug onder 'n druk en by 'n temperatuur van onderskeidelik 14.7 lb./vk. dm. abs. en 80° F. Verdigting van die lug is adiabaties, en die verdigtingsverhouding is 13.5:1. Hitte word ontvang onder konstante druk en die afsluitverhouding is 2.2:1. Uitsetting gaan dan adiabaties voort tot by die end van die slag wanneer uitlaat plaasvind onder konstante volume.

Bepaal die temperatuur by die ander drie opvallende punte van die siklus en die termies nuttige effek van die enjin.

Let wel.— $C_p = 0.238$, $C_v = 0.17$ en $\gamma = 1.4$.

9. Stoom verlaat die straalpyp van een stadium van 'n aksieturbine teen 'n snelheid van 2,000 vt./sek. Die straalpyp vorm 'n hoek van 15 grade met die vlak van die rat. Die gemiddelde snelheid van die lemme is 800 vt./sek. en die snelheidskoeffisiënt vir die lemme is 0.9. Bepaal (a) die lemhoeke sodat die stoom sonder skok kan binnegaan en in 'n aksiaalrigting kan uitgaan, (b) die krag wat ontwikkel word en die aksiaal-stukrag vir 'n stroomtoevoer van 720 lb./uur. 'n Grafiese oplossing sal aanvaar word.

5. The profile of a cam is such that it gives a simple harmonic motion to the follower for both the instroke and the outstroke. The stroke of the follower is 4 in. and the line of stroke passes through the centre of the camshaft. If the speed of the camshaft is 300 r.p.m. and the follower has moved $\frac{1}{2}$ in. from the beginning of its stroke, find the velocity and acceleration of the follower. If the follower and its attachments weigh 4 lb., find the kinetic energy of the follower for the above position.

6. A disc lies in a horizontal plane and is free to rotate; a mass is placed on the disc at 18 in. from the axis of rotation. If the coefficient of friction between the disc and the mass is 0.4, find (a) the maximum velocity in r.p.m. and (b) the maximum acceleration in radn/sec/sec. that can be given to the disc without the mass slipping.

7. The winding barrel of a winch has, having regard to the size of the wire, an effective diameter of 2 ft. The barrel together with the shaft, spur wheel, etc., weighs 600 lb. and the radius of gyration of the assembly is 10 in. Calculate the tension in the wire and the driving torque required when the winch is lifting a load of 5 cwt. with an acceleration of 0.5 ft/sec/sec.

8. The impeller of a centrifugal pump is 2 ft. 6 in. in external diameter and runs at 100 r.p.m. If the water leaves the vanes with a radial velocity of 5 ft./sec. and a tangential velocity of 5 ft./sec. in the direction of rotation, calculate the angle of the vane at outlet, relative to the tangent, which will allow the water to leave the vane without shock.

9. The four rings of shell plating of an air reservoir, which is 5 ft. 3 in. in internal diameter, are $1\frac{1}{2}$ in. in thickness. The plates are cut obliquely and butt welded, the butt welds making spiral angles of 45 degrees with the circumferential joints, which are also welded. If the working pressure is 400 lb/sq. in., what is the normal tensile stress at (a) the circumferential weld, (b) the oblique weld?

CHIEF ENGINEER-OFFICER.

HEAT AND HEAT ENGINES—A II.

Do not deface or make any marks on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted.

(Time allowed: 3 hours.)

1. A vessel has three boilers each 17 ft. diameter and 13 ft. long, and before applying heat-insulating material to the boilers the temperature of their outside surfaces was 350°F., while the stokehold temperature was 100°F. After insulating the boilers, however, the temperature at the surface of the insulation was 150°F., and the stokehold temperature was 90°F. If the coal used had a calorific value of 12,500 B.Th.U. per lb., calculate the quantity saved in tons per day by this means, assuming that both ends of each boiler were insulated in addition to the shell plates.

Note.—The quantity of heat Q radiated from a surface which is at an absolute temperature of T (°F.) is given by $Q = k T^4$ B.Th.U./sq/ft/hr., where $k = 16 \times 10^{-10}$.

2. In a double-effect evaporation plant, exhaust steam at 37 lb/sq. in. abs. and 0.9 dry is supplied to the first evaporator coil and leaves the drain as water at 200°F.

The dry saturated vapour from this evaporator is taken to the coil of the second evaporator at 20 lb/sq. in. abs. and leaves the drain as water at 170°F. The vapour from the second evaporator is dry saturated at 7 lb/sq. in. abs. and raw water at 80°F. is fed to the shell of both evaporators.

Calculate the total weight of raw water evaporated from both evaporators for one pound of the original exhaust steam.

3. Steam at 40 lb/sq. in. abs. and dry saturated passes through a convergent nozzle with an exit area of 3.5 sq. in. to a final pressure of 25 lb/sq. in. abs., dryness fraction 0.98. Calculate the weight of steam discharged per minute.

4. In the manufacture of lead pipes the solid hot lead ingot is passed through an annular die by a pressure of 1,390 Kg/sq. cm. on a plunger working in the cylinder in which the lead is contained. If the work done on the lead in forcing it through the die is converted into heat, find the rise of temperature of the lead as it passes through the die, in Centigrade degrees.

5. Owing to condenser tube leakage the weight of solids in the hotwell water, per unit volume, is 0.25 that of the sea water and it is found necessary to resort to a continuous blowing down of the boiler which generates dry saturated steam at 240 lb/sq. in. abs. from feed at 120°F. If the fuel consumption has increased by 3.8 per cent due to the wastage, find, with the aid of the Steam Tables provided, the density of the boiler water given that the composition of the solid matter in sea water is as follows:—

Sodium chloride.....	3.52 oz/gall.
Magnesium chloride.....	0.45 oz/gall.
Magnesium sulphate.....	0.32 oz/gall.
Calcium sulphate.....	0.16 oz/gall.
Calcium carbonate.....	0.04 oz/gall.

6. A quadruple expansion engine takes steam at 225 lb/sq. in. abs. and exhausts at 2 lb/sq. in. abs. The cylinder volumes are in the ratio of 1:2.08:4:327:9. The total number of expansions is 14 and the cut-off in both the first and second I.P. cylinders is 0.62, while the cut-off in the L.P. cylinder is 0.75.

Assuming that the steam expands throughout the engine according to the law $PV = C$ and neglecting clearance and all losses, determine (a) the absolute pressure at cut-off in each cylinder, and (b) the ratio of the four piston loads during admission.

7. A six-cylinder single-acting petrol engine works on the four-stroke cycle and the cylinder bore and stroke are 3.5 and 4.5 in. respectively. The fuel used contains 84 per cent carbon and 16 per cent hydrogen by weight. When running at 3,000 r.p.m. the volumetric efficiency at 32°F. and 14.7 lb/sq. in. abs. is 0.76. Calculate the fuel consumption in lb/hr. if the engine works with an air-fuel ratio for chemically correct combustion. Take R for the mixture as 51.2. Air contains 23 per cent of oxygen by weight, the atomic weight of hydrogen, carbon and oxygen are 1, 12 and 16 respectively.

8. An engine working on the ideal Diesel cycle is supplied with air at a pressure and temperature of 14.7 lb/sq. in. abs. and 80°F. respectively. Compression of the air is adiabatic, the compression ratio being 13.5:1. Heat is received at constant pressure and the cut-off ratio is 2.2:1. Expansion then proceeds adiabatically to the end of the stroke when exhaust takes place at constant volume.

Determine the temperature at the other three salient points of the cycle and the thermal efficiency of the engine.

Note.— $C_p = 0.238$, $C_v = 0.17$ and $\gamma = 1.4$.

9. Steam leaves the nozzles of one stage of an impulse turbine at a velocity of 2,000 ft/sec. The nozzle makes an angle of 15 degrees with the plane of the wheel. The mean speed of the blades is 800 ft/sec. and the velocity coefficient for the blades is 0.9. Find (a) the blade angles so that the steam may enter without shock, and leave in an axial direction, (b) the power developed and the axial thrust for a steam flow of 720 lb/hr. A graphical solution will be accepted.

HOOF-INGENIEUROFFISIER.

ELEKTROTEGNIK—B I.

Moenie hierdie vraestel skend of merke hoegenaamd daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae. Een vraag uit elke afdeling moet beantwoord word en nog drie ander vrae.

(Tyd toegelaat: 3 uur.)

AFDELING A.

1. Die anker en stroomveldweerstand van 'n newestroommotor van 220 volt is onderskeidelik 0.25 en 110 ohms en wanneer die motor sonder 'n belasting loop, neem dit 6A.
Bereken die verliese as gevolg van yster, wrywing en wrywing van die lug en, as veronderstel word dat hierdie waarde konstant bly met alle belasting, bepaal die rendement wanneer die krag voorsien 62A is.
2. 'n Battery bestaande uit 48 selle, met 'n inwendige weerstand van 0.012 ohm per sel, moet gelaai word sodat die E.M.K. per sel verhoog word van 1.85 tot 2.60 volt.
Bepaal die maksimum-aantal koolstoflampe van 'n parallelgeskakelde battery wat in serie met die kragkring aangeskakel kan word sodat die stroom van die hoofgeleidings van 220 volt nie 10A by die aanvang van die lading oorskry nie.
As die kragkring onveranderd bly, bereken die stroom wat deur die battery vloei wanneer die lading net voltooiing nader.
Elke lamp is gemerk 110 volt, 32 kerskrag en vereis 3.7 watt per kerskrag.
3. Die magnetiese stroomveld in die lugtussenruimte van 'n tweepolige motor het 'n stromingsdigtheid van 0.8 weber per vierkant-meter (8,000 gauss). Die anker is bewikkel met 246 geleiers, elk met 'n effektiewe lengte van 16 dm., gemonteer in effektiewe straal van 6 dm., en met 'n volle belasting dra elke geleier 'n stroom van 20A. Gestel dat die werklike momentkoppel wat gelewer word ekwivalent is aan die wat toe te skryf is aan twee-derdes van die aantal geleiers wat die kraglyne reghoekig kruis, bepaal (a) die momentkoppel in pondvoet en (b) die asperdekrag wat ontwikkel word teen 500 o.p.m.

AFDELING B.

4. Verduidelik die onderliggende beginsels vir die noodsaaklikheid om die uitdrukking „Kragfaktor” in te voer wanneer W.S.-masjinerie bespreek word.
'n Wisseldinamo voorsien 'n lading van 500 kW. teen 'n kragfaktor van 0.7. As apparaat geïnstalleer word wat die kragfaktor tot 0.8 verhoog, bereken die vermeerdering in die krag beskikbaar vir dieselfde kVA-lading.
5. 'n Verwarmingseenheid van onbeduidende inductans het 'n weerstand van 6.5 ohms en is bedoel vir gebruik by hoofleidings van 100 volt. Vir watter 50-siklus-stroomspanning sal dit geskik wees as dit in serie geplaas word met 'n uitwendige apparaat van onbeduidende weerstand, met 'n inductans van 0.01 henry.
As die frekwensie met 5 persent styg en hierdie stroomspanning konstant bly, wat sal die gevolglike verandering in stroomspanning wees by die verwarmingsklemme?
6. Verklaar kortliks die betekenis van die uitdrukkings „ster-verbindings” en „delta-verbindings” soos toegepas op driedfasige W.S.-praktyk. Wat is die verhouding van die maksimum-lynstroomspanning tot die maksimum-fasestroomspanning in elke geval?
Bepaal die lynstroom wat verbruik word deur 'n driedfasige, ster-verbindingsmotor van 440 volt met 'n opbringsvermoë van 60 perdekrag teen 'n kragfaktor van 0.88 en 'n rendement van 93 persent.

AFDELING C.

7. Spesiale vereistes wat betrekking het op die verdeling van elektriese energie en die nodige ondergeskikte uitrusting geld in olietenskepe. Met verwysing hierna, wat is die beperkende stroomspanning vir (a) krag, (b) beligting en verwarming, met onderskeidelik G.S. en W.S.?
Noem die stelsel waarvolgens hoofgeleidingsverdeling bewerkstellig word en die tipe kabel wat gebruik kan word. Wat is die vereistes met betrekking tot draagbare lampe en die verligting van pompkamers?
8. Beskryf 'n kortsluitanker-induksiemotor en sy werkbeginsele. Gee 'n beredeneerde verduideliking van die uitwerking wanneer die momentkoppel vermeerder word.
9. Verduidelik die rede vir die installasie van tussenpole in G.S.-masjinerie. Skets twee aangrensende hoofpole van 'n vierpolige generator, en toon aan die rigting waarin die stroom vloei in die stroomveldbewikkeling en die rotasierigting; sluit 'n tussenpoolse bewikkeling in.
Hoe vergelyk hierdie inrigting met die van 'n soortgelyke masjien wat gebruik word as motor om in dieselfde rigting te loop?

HOOF-INGENIEUROFFISIER.

SKEEPSONTWERP—B I.

Moenie hierdie vraestel skend of merke hoegenaamd daarop maak nie.

Moenie die vrae afskryf nie.

Gegewens wat miskien benodig sal word, kan gevind word in die wiskundetafels wat verskaf word.

Beantwoord NET ses vrae, waarvan drie uit Afdeling A gekies moet word.

(Tyd toegelaat: 3 uur.)

AFDELING A.

1. 'n Piekbeskot is 24 voet diep en die ordinate van wydte met tussenposes van 6 vt. is onderskeidelik 26, 23, 19, 13 en 0 vt. Die piektenk is vol soutwater en soutwater styg tot 'n hoogte van 12 vt. aan die ander kant van die beskot. Tussen-ordinate van wydte op hoogtes van 3 vt. en 9 vt., gemeet vanaf die bodem van die beskot, is onderskeidelik 8 vt. en 16.5 vt. Bepaal (a) die drukpunt met betrekking tot die bopunt van die tenk en (b) die totale druk op die beskot, in ton.
2. Stel 'n formule op wat verplasing, indikateur-perdekrag, snelheid en die Admiraliteitskoëffisiënt verbind. Met gebruik van hierdie formule, skat die indikateur-perdekrag wat na verwagting benodig sal word om 'n skip met 'n waterverplasing van 14,560 ton teen 'n snelheid van 17 knope per uur aan te dryf.

CHIEF ENGINEER-OFFICER.

ELECTROTECHNOLOGY—B I.

Do not deface or make any marks whatever on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six Questions ONLY to be attempted. One question from each section must be attempted and any three others.

(Time allowed: 3 hours.)

SECTION A.

1. The armature and field resistances of a 220V shunt motor are 0.25 and 110 ohms respectively and when running on no load the motor takes 6A.

Calculate the losses attributable to iron, friction and windage and, assuming this value to remain constant at all loads, determine the efficiency when the current supplied is 62A.

2. A battery consisting of 48 cells, having an internal resistance of 0.012 ohm per cell, is to be charged so that the emf per cell is raised from 1.85 to 2.60V.

Determine the maximum number of carbon lamps of a parallel bank which may be switched on in series with the circuit so that the current from the 220V mains does not exceed 10A at the commencement of charging.

If the circuit remains unaltered, calculate the current flowing through the battery when the charge is just approaching completion. Each lamp is marked 110V, 32 cp and requires 3.7 watts per candle power.

3. The magnetic field in the air gap of a two-pole motor has a flux density of 0.8 Weber per sq. meter (8,000 gauss). The armature is wound with 246 conductors each of 16 in. effective length mounted at 6 in effective radius, and at full load each conductor carries a current of 20A. Assuming that the actual torque produced is equivalent to that due to two-thirds of the number of conductors cutting the lines of force at right-angles, find (a) the torque in pound feet, and (b) the shaft horse power developed at 500 r.p.m.

SECTION B.

4. Explain the principles underlying the necessity for the introduction of the term "Power Factor" when considering A.C. machinery.

An alternator is supplying a load of 560 kW. at a power factor of 0.7. If apparatus is installed that raises the power factor to 0.8, calculate the increase in power available for the same kVA loading.

5. A heater unit of negligible inductance has a resistance of 6.5 ohms and is intended for use with 100V mains. For what 50 cycle voltage would it be suitable when placed in series with an external apparatus of negligible resistance, having an inductance of 0.01 henry?

If the frequency rises by 5 per cent and this voltage remains constant, what would be the resulting change of voltage at the heater terminals?

6. State briefly, the meaning of the expressions "star-connected" and "delta-connected" as applied to three-phase A.C. practice. What is the ratio of the maximum line voltage to the maximum phase voltage in each case?

Determine the line current taken by a 440V, 3-phase, star-connected motor having an output of 60 HP at 0.88 power factor and an efficiency of 93 per cent.

SECTION C.

7. Special requirements appertaining to the distribution of electrical energy and the necessary ancillary equipment obtain in oil tankers. With reference to these, what is the limiting voltage for (a) power, (b) lighting and heating, with D.C. and A.C. respectively?

State the system whereby main distribution is effected and the type of cable which may be used. What are the requirements relating to portable lamps and the illumination of pump rooms?

8. Describe a squirrel-cage induction motor and its working principle. Give a reasoned explanation of the effect of increasing the torque.

9. Explain the reason for the fitting of interpoles in D.C. machinery. Sketch two adjacent main poles of a four-pole generator, showing the direction of current flow in the field winding and direction of rotation; include an interpole winding.

How does this arrangement compare with that of a similar machine used as a motor to run in the same direction?

CHIEF ENGINEER-OFFICER.

NAVAL ARCHITECTURE—B I.

Do not deface or make any marks whatever on this paper.

Do not copy the questions.

Data that might be required may be found in the mathematical tables provided.

Six questions ONLY to be attempted, at least three of which must be from Section A.

(Time allowed: 3 hours.)

SECTION A.

1. A peak bulkhead is 24 ft. in depth and the ordinates of width, at intervals of 6 ft. are 26, 23, 19, 13 and 0 ft. respectively. The peak tank is full of sea water and sea water rises to a height of 12 ft. on the other side of the bulkhead. Intermediate ordinates of width at heights of 3 and 9 ft. measured from the bottom of the bulkhead, are 8 and 16.5 ft. respectively. Determine (a) the centre of pressure relative to the top of the tank and (b) the total pressure on the bulkhead, in tons.

2. Establish a formula connecting displacement, i.h.p., speed and the Admiralty coefficient. Using the formula, estimate the i.h.p. anticipated to be required to propel a vessel of 14,560 tons displacement at a speed of 17 knots.

3. Verklaar kortliks die betekenis van die simbole B, G, M, KM, BM en GM. Toon aan die verhouding tussen hierdie simbole. 'n Kasvormige skip, 28 vt. wyd en 20 vt. hoog dryf met 'n diepgang van 12 vt. in soutwater. Die ton per duim indompeling is 12. As gevolg van beskadiging loop twee kompartemente vol water. Die swaartepunt van die een kompartement is 50 vt. voor die swaartepunt van die skip en die afstand tussen die swaartepunte van die twee kompartemente is 100 vt. Die voorste kompartement is 45 vt. lank en sy deurdringbaarheid is 70 persent, terwyl die ander kompartement 35 vt. lank is en sy deurdringbaarheid 90 persent is. Bepaal die nuwe diepgang.

4. Stel die Wet van Vergelyking van Froude en meld hoe dit gebruik word om die weerstand van 'n skip uit modelgegevens vas te stel. Die golfopwekkingsweerstand van 'n model van 12 vt. is 1.65 lb. teen 'n snelheid van 500 vt./min. Bepaal die perdekrag wat benodig word om die golfweerstand te bowe te kom van 'n skip 300 vt. lank van soortgelyke vorm wanneer dit teen 'n ooreenstemmende snelheid vaar.

5. 'n Skip met 'n verplasing van 13,570 ton lê gelyklastig met 'n diepgang van 29 vt. 3 dm., en die moment om die trim 1 dm. te verander, is 935 ton voet. Vragveranderinge vind soos volg plaas: 370 ton word gelaai 67 vt. agter die swaartepunt van die skip, terwyl 53 ton ontlai word uit 'n posisie 57 vt. voor die swaartepunt van die skip. As die ton per duim binne die omvang van die betrokke diepgange 59 is en die dryfmiddelpunt op middellengte bly, bepaal die nuwe diepgange voor en agter.

AFDELING B.

6. Verduidelik die funksie van 'n aanvaringskot en, met behulp van sketse, beskryf die hoofboukenmerke met spesiale verwysing na sterkte, bevestiging aan dekke, rompplate en dubbelbodem.

7. Skets en beskryf die inrigting van die roerstok, drukstuk en suspensie van 'n roer sonder roerhaak.

8. By die bou van 'n selvormige dubbelbodem van 'n skip word sekere boudele beskryf as deurlopend en ander as tussengevoegd. Wat word met hierdie uitdrukkings bedoel? Toon deur middel van sketse watter dele van die skeepstruktuur so toegerus is en noem die dele.

9. Wat word bedoel met galvaniese werking? Meld watter dele van 'n skip se romp en toebehore mees algemeen lekkasie opdoen as gevolg van galvaniese werking en die teenmaatreëls wat getref word. Beskryf 'n stelsel wat aangewend kan word om lekkasie te beheer.

HOOF-INGENIEUROFFISIER.

INGENIEURSWESE—B II.

OGGENDVRAESTEL.

ALLE KANDIDATE.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vrae afskryf nie.

Vraag EEN moet beantwoord word en daarbenewens nog vyf vrae.

(Tyd toegelaat: 3 uur.)

1. Beskryf in die vorm van 'n verslag gerig aan die Ingenieur-superintendent van 'n skeepseienaar, die omstandighede wat gepaard gaan met die buiging van die suierstang van 'n hoofmasjien. In die verslag moet volledig vermeld word die waarskynlike oorsaak van die buiging, die stappe wat gedoen is om die skip in hawe te bring en moet voorkomingsmaatreëls vir die toekoms aan die hand gedoen word.

2. Watter brandblussingsstoestelle behoort, na u mening, voorsien te word in die masjienruime van 'n skip wat olie as brandstof verbruik? Beskryf hulle en verduidelik hoe hulle werk, asook hoe die blussingsmedium op die brand reageer. Watter sorg vereis hierdie toestelle van tyd tot tyd? Meld die tipe en benaderde perdekrag van die masjinerie in die skip waarvan in u antwoorde melding gemaak word.

3. Wat is die fisiese eienskappe wat vereis word in materiaal wat bedoel is vir gebruik as:—

- | | |
|-----------------------|-----------------|
| (a) Dryfstangbout; | (d) suierringe; |
| (b) die ankerkern; | (e) heksante? |
| (c) verdampingspoele; | |

Noem en beskryf die aard van die materiaal wat u vir elk geskik ag.

4. Beskryf, met sketse, 'n elektro-hidroulise stuurinrigting met telemotor-kontrole. Dui aan hoe daar verligting gebring word wanneer die roer getref word deur 'n onstuimige see en hoedat dit vanself na sy vorige posisie terugkeer.

5. Verduidelik volledig die metode waarvolgens die kompressorsuiers en suierstange van 'n kooldioksied- of ammoniak-koelmasjien gesmeer word, asook die beginsel waarvolgens enige toestel wat gebruik word om hierdie doel te bewerkstellig, werk. Beskryf die suier en suierstangverpakking, en die eienskappe wat vereis word van die smeerolie. Van watter materiaal word die dele gemaak wat in aanraking is met die verkoelingsmiddel in die geval van 'n ammoniakmasjien, en waarom?

6. Beskryf die bou van 'n sentrifugale sirkulasiepomp, en verduidelik hoe dit werk. Gee u menings oor die geskiktheid van rubber vir die dryfrataskoeëlaars.

7. Ontploffings het plaasgevind in olietenkskepe in hawe en ter see. Hoe kan so 'n ramp veroorsaak word en watter maatreëls behoort getref te word om dit te voorkom?

8. Beskryf 'n ketelwaterpeilglas wat op 'n afstand gelees kan word en wat nie op die waterpeil gemonteer hoef te word nie. Meld duidelik hoedat die peilglas gelaai en getoets word. Hoe kan dit gebeur dat so 'n peilglas 'n onjuiste lesing kan registreer?

9. Beskryf 'n stelsel van meganiese ventilering vir die woonruimtes aan boord van 'n skip. Hoe word die temperatuur van die lug gereguleer? Watter aandag moet aan die ventilasie-installasie gegee word ten einde dit in 'n bevredigende werkende toestand te behou?

3. State, briefly, the meaning of the symbols B, G, M, KM, BM, and GM. Show how they are related to each other. A box-shaped vessel, 28 ft. in breadth and 20 ft. in depth, floats at a draught of 12 ft. in sea water. The t.p.i. is 12. Owing to damage two compartments are bilged. The CG of one is 50 ft. forward of the CG of the vessel and the distance between the CGs of the two compartments is 100 ft. The forward one is 45 ft. in length and of 70 per cent permeability, while the other one is 35 ft. in length and of 90 per cent permeability. Determine the new draught.

4. State Froude's Law of Comparison and state how it is employed to determine the resistance of a ship from model data. The wave making resistance of a 12 ft. model is 1.65 lb. at a speed of 500 ft/min. Find the h.p. required to overcome wave resistance of a 300 ft. ship of similar form when running at corresponding speed.

5. A vessel of 13,570 tons displacement rests on an even keel at a draught of 29 ft. 3 in., and the moment to change trim one inch is 935 ton ft. Cargo alterations take place as follows: 370 tons are loaded 67 ft. aft of the CG of the vessel while 53 tons are discharged from a position 57 ft. forward of the CG of the vessel. If the t.p.i. within the range of draughts concerned is 59 and the centre of flotation remains at mid length, determine the new draughts forward and aft.

SECTION B.

6. Explain the function of a collision bulkhead and, with the aid of sketches, describe the principal features of construction with special reference to strength, attachment to decks, shell plating and double bottom.

7. Sketch and describe the arrangement of a rudder stock, gland and suspension for a pintleless rudder.

8. In the construction of the cellular double bottom of a ship certain members are described as continuous and others as intercostal. What is meant by these terms? Show by means of sketches which parts of the structure are so fitted and name the parts.

9. What is meant by galvanic action? State which parts of a vessel's hull and fittings most frequently suffer wastage by galvanic action and the counter measures taken. Describe a system which could be employed to control the wastage.

CHIEF ENGINEER-OFFICER.

ENGINEERING KNOWLEDGE—B II.

MORNING PAPER.

ALL CANDIDATES.

Do not deface or make any marks on this paper.

Do not copy the questions.

Question ONE must be attempted and any five other questions.

(Time allowed: 3 hours.)

1. Describe, in the form of a report addressed to an Engineer Superintendent or a Shipowner, the circumstances attending the bending of a main engine piston rod. The report should state fully the probable cause of the bending, the steps taken to bring the ship to port, and suggest preventive measures for the future.

2. What fire-extinguishing appliances do you consider should be provided in the machinery spaces of a ship using oil as fuel? Describe them and explain how they are operated, also how the extinguishing medium acts on the fire. What attention do these appliances require from time to time? State the type and approximate horse-power of the machinery in the vessel to which your answer refers.

3. What are the physical properties required in materials intended for use as:—

- | | |
|------------------------------|-------------------|
| (a) Connecting rod bolts; | (d) piston rings; |
| (b) the core of an armature; | (e) stern frames? |
| (c) evaporator coils; | |

Name and describe the nature of the material you consider suitable in each case.

4. Describe, with sketches, an electro-hydraulic steering gear having telemotor control. Indicate how the rudder is relieved when struck by a heavy sea and how it is automatically returned to its former position.

5. Explain fully the method of lubricating the compressor pistons and piston rods of a carbon dioxide or ammonia refrigerating machine, also the principle upon which any appliance used to effect this purpose works. Describe the piston and piston rod packing, and the properties required of the lubricating oil. Of what materials are the parts made which are in contact with the refrigerating medium in the case of an ammonia machine, and why?

6. Describe the construction of a centrifugal circulating pump, and explain its action. Give your views as to the suitability of rubber for the impeller shaft bearings.

7. Explosions have occurred on oil tankers in harbour and at sea. How may such a disaster be caused, and what measures should be adopted with a view to prevention?

8. Describe a distant-reading boiler water-gauge which does not require to be mounted at water level. State clearly how the gauge is charged and tested. How might such a gauge give a false reading?

9. Describe a system of mechanical ventilation for the living spaces on board ship. How is the temperature of the air regulated? What attention does the ventilating installation require to maintain it in a satisfactory working condition?

HOOF-INGENIEUROFFISIER.

INGENIEURSWESE—B II.

MIDDAGVRAESTEL.

KANDIDATE VIR 'N STOOMSERTIFIKAAT.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vrae afskryf nie.

Beantwoord *NET* ses vrae.

(Tyd toegelaat: 3 uur.)

1. Beskryf 'n stelsel van geforseerde smering vir 'n stel turbines met tandrattoerbrenging. Lig u antwoorde toe met diagammatiese sketse, en meld die drukings by verskillende punte van die stelsel, asook die wyse waarop olie gerekondisioneer kan word en die hoeveelheid wat moontlik per dag verlore gaan.

2. Gee 'n voorbeeld van gevalle waar (a) groefvorming, (b) invreting, en (c) lekkasie in 'n silinderketel voorkom. Meld in elke geval die moontlike oorsaak van die defek, en doen aan die hand 'n bevredigende manier waarop dit herstel kan word en die stappe wat gedoen moet word om te voorkom dat dit weer gebeur.

3. Beskryf, met behulp van sketse, 'n-sentrifugale tipe van voedingspomp wat geskik is vir die voorsiening van voeding aan 'n waterpypketel wat onder 'n druk van 450 lb./vk. dm. werk. Toon hoe die aksiale stukrag van 'n pomp hidroulies gebalanseer kan word.

4. Hoe kan die klepinrigting van elke silinder van 'n drievoudige ekspansiemasjien onafhanklik verbind word? Watter uitwerking het die verbinding en die opening van die laedrukklepinrigting op (a) die stoomverbruik, (b) die krag wat in die afsonderlike silinders ontwikkel word, (c) die totale krag en (d) die vorm van die indikateurdiagram?

5. Beskryf, met behulp van 'n skets, 'n „volleboor“-tipe veiligheidsklep. As die klep gebruik word as 'n oorverhittingsveiligheidsklep, vergelyk die uitwerking wanneer die kontroleklep geplaas word op die hoofstoomtrommel met die uitwerking wanneer dit ingelyf word in die skuifkas op die oorverhittingsuitlaatklep.

6. Gee 'n ten volle beredeneerde verduideliking van die uitwerking wat 'n verlies aan lugleegte sou hê op die temperatuur van die laedrukturbine-uitlaat as so 'n verlies veroorsaak was deur (a) luglekkasie, (b) vuil kondensatorbuis. Noem 'n paar moontlike bronne van luglekkasie in die stelsel en beskryf hoedat sodanige lekkasies opgespoor en reggestel kan word.

7. Maak sketse met afmetings van die inrigting van plate en klinknaels by die aansluiting van die oorlangse rompnaat en die omtrek-belegplaatnaat van 'n groot silindriese ketel. Bespreek die betreklike sterkte van die plaat- en klinknaatseksies in die oorlangse rompnaat, en dui aan die verskillende maniere waarop hierdie oorlangse las as gevolg van te hoë druk kan faal.

8. Met behulp van ruwe sketse, dui aan die bou van drie verskillende soorte moderne marinewaterpypketels.

Gee u menings in verband met hul kenmerkende eienskappe en betreklike voordele, veral vanuit die gesigspunt van toeganklikheid vir skoonmaak-, nasien- en hersteldoelindes, fasiliteite vir tydelike herstelwerk soos die toestop of vervanging van gebarste pype en betroubaarheid vir hoë en aanhoudende stoming.

9. In die geval van 'n turbine-installasie wat hoëdrukstoom gebruik, word voedingsverhitting soms in twee of drie stadiums bewerkstellig. Maak 'n sketsdiagram van so 'n inrigting en toon daarop aan die verwarmings- en voedingspypverbindings. Beskryf die inrigting en meld die bronne van die verwarmingstoomtoevoer, die benaderde druk waaronder die stoom die verwarmers binnegaan, en die wyse waarop daar beskik word oor die verdigte water.

HOOF-INGENIEUROFFISIER.

INGENIEURSWESE—B II.

MIDDAGVRAESTEL.

KANDIDATE VIR MOTORSERTIFIKATE.

Moenie hierdie vraestel skend of merke daarop maak nie.

Moenie die vrae afskryf nie.

Beantwoord *NET* ses vrae.

(Tyd toegelaat: 3 uur.)

1. Beskryf, met sketse, 'n brandstofinspuitklep vir 'n swaar binnebrandmasjien wat olie verbruik. Verduidelik hoe dit werk. Meld hoe die hoeveelheid brandstof afgewissel word om aan te pas by die verskillende belastings en noem die tydperk van inspuiting.

2. Beskryf die werk wat gedoen moet word om die suier van 'n swaar hoofmasjien wat olie verbruik vir ondersoek te verwyder. Watter ondersoek sal u instel, watter notas sal u maak, en wat is, na u mening, die defekte wat opgespoor sal word? Beskryf enige verstellings wat nodig mag wees voordat die suier teruggesit word.

3. Gevalle van krukkasontploffings het voorgekom met ernstige gevolge in party gevalle. Wat kon, na u mening, die oorsaak of oorsake gewees het van hierdie ontploffings, en watter maatreëls sou u aan die hand doen met die oog op die vermindering van die gevaar van ontploffings? Beskryf kortliks 'n ontwerp wat 'n waarskuwing sou gee wanneer gevaarlike toestande in die krukkas ontwikkel.

4. Hoe word die omkering van 'n groot binnebrandmasjien bewerkstellig? Beskryf 'n omkeerbeweging en verduidelik hoe dit werk. Hoe kan 'n silinder onthef word van 'n oormatige druk wanneer die masjien omgekeer word?

5. Beskryf party van die defekte wat u ter see in motorskepe ondervind het wat noodsaak het dat die hoofmasjiene stopgesit moes word. Wat was die oorsaak van die defekte en hoe is hulle verhelp?

6. Watter nuttige gebruik kan gemaak word van die hitte bevat in die uitlaatgasse van 'n swaar hoofmasjien wat olie verbruik? Beskryf volledig enige metode waarvolgens die hitte van uitlaatgasse aangewend kan word, en meld die tipe masjien waarop u antwoord betrekking het.

7. Wat is die betekenis van die uitdrukking volumetriese rendement soos toegepas op 'n lugperspomp? Beskryf die bou van 'n drie-stadiumlugperspomp en verduidelik hoe dit werk, met vermelding van die drukings wat in die verskillende stadiums verkry word. Watter voordele het 'n veelstadiumlugperspomp oor die van 'n eenstadiumtipe?

8. Beskryf die bou van 'n lugaansitklep en verduidelik volledig hoe dit werk. Watter gevaar kan ontstaan as gevolg van 'n klep wat lek, en hoe kan die klep getoets word vir digtheid? Wat is die gewone druk vir die aansitlug, en binne watter perke van drukking kan 'n swaar hoofmasjien wat olie verbruik, aan die loop gehou word?

9. Wat is 'n trekkaardiagram en hoe kan dit verkry word? Teken die gewone diagramme met trekkaardiagramme daarop gelê vir die volgende gevalle: (a) normale geval, ontsteking met die tyd behoorlik gereël, (b) vroeë ontsteking, en (c) laat ontsteking. Verduidelik die uitwerking van (b) en (c) op die werking van die masjien. Toon aan die uitwerking van nabranding op 'n indikateurdiagram.

CHIEF ENGINEER-OFFICER.

ENGINEERING KNOWLEDGE—B II.

AFTERNOON PAPER.

STEAM CANDIDATES.

Do not deface or make any marks on this paper.

Do not copy the questions.

Six questions *ONLY* to be attempted.

(Time allowed: 3 hours.)

1. Describe a system of forced lubrication for a set of geared turbines. Illustrate your answer with diagrammatic sketches, and state the pressures at various points of the system, also the means by which oil is reconditioned, and the amount possibly lost per day.
2. Give an example of the occurrence of (a) grooving, (b) pitting, (c) wastage in a cylindrical boiler. In each case state the probable cause of the defect, and suggest a satisfactory repair and the action to take to prevent further occurrence.
3. Describe, with the aid of sketches, a centrifugal type feed pump suitable for supplying feed to a water tube boiler working at 450 lb/sq. in. Show how the axial thrust of the pump may be balanced hydraulically.
4. How may the valve gear of each cylinder of a triple-expansion engine be linked up independently? What effect has linking up and opening out the low pressure valve gear on (a) the steam consumption, (b) the power developed in the separate cylinders, (c) the total power and (d) the shape of the indicator diagram?
5. Describe, with the aid of a sketch, a "full bore" type safety valve. If the valve be used as a superheater safety valve, compare the effect of placing the pilot valve on the main steam drum with that of incorporating it in the valve chest on the superheater outlet.
6. Give a fully reasoned explanation of the effect that a loss vacuum would have on the L.P. Turbine Exhaust temperature if such a loss was caused by (a) air leakage, (b) dirty condenser tubes. Give some possible sources of air leakage to the system and describe how such leaks may be detected and rectified.
7. Give dimensioned sketches of the arrangement of plates and rivets at the junction of the longitudinal shell seam and the circumferential end plate seam of a large cylindrical boiler. Discuss the relative strength of plate and rivet sections in the *longitudinal shell seam* and indicate the different ways in which this longitudinal joint may fail as the result of over-pressure.
8. With the aid of rough sketches, indicate the construction of three different types of modern marine water tube boilers. Express opinions regarding their characteristic features and relative advantages, particularly from the aspects of accessibility for cleaning and overhaul, facilities for effecting temporary repairs such as the stopping or replacement of burst tubes and reliability for hard and continuous steaming.
9. In the case of a turbine installation using high-pressure steam, feed heating is sometimes effected in two or three stages. Make a skeleton diagram of such an arrangement and show thereon the heating and feed pipe connections. Describe the arrangement and state the sources of the heating steam supply, the approximate pressure at which the steam enters the heaters, and the manner of disposal of the water of condensation.

CHIEF ENGINEER-OFFICER.

ENGINEERING KNOWLEDGE—B II.

AFTERNOON PAPER.

MOTOR CANDIDATES.

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Do not copy the questions.

Six questions *ONLY* to be attempted.

(Time allowed: 3 hours.)

1. Describe, with sketches, a fuel injection valve for a heavy oil internal combustion engine. Explain its action, state how the quantity of fuel is varied to suit different loads, and give the period of injection.
2. Describe the operation of removing the piston of a heavy oil main engine for inspection. What inspection would you make, what notes would you take, and what defects do you think might be found? Describe any adjustments that may be necessary before replacing the piston.
3. Instances of crank case explosions have occurred with serious results in some cases. What do you consider may have been the cause or causes of these explosions, and what measures would you suggest with a view to minimising the danger of explosion? Describe, briefly, a device which would give warning of dangerous conditions in the crank case.
4. How is reversal of a large internal combustion engine accomplished? Describe a reversing gear and explain its action. How may a cylinder be relieved of excessive pressure when the engine is being reversed?
5. Describe some of the defects necessitating the stopping of the main engines that you have experienced at sea in motor vessels. What caused the defects and how were they remedied?
6. To what useful purpose may the heat contained in the exhaust gases of a main heavy oil engine be put? Describe fully any method of utilising the heat of exhaust gases, and state the type of engine to which your answer refers.
7. What is the meaning of the term volumetric efficiency as applied to an air compressor? Describe the construction of a three-stage air compressor and explain its action, stating the pressures obtained at the different stages. What advantages does a multiple-stage compressor possess over one of a single-stage type?
8. Describe the construction of an air starting valve and explain fully how it is operated. What danger may arise from a leaky valve, and how may the valve be tested for tightness? What is the usual pressure for starting air, and within what limits of pressure may a main heavy oil engine be operated?
9. What is a draw card diagram, and how may it be obtained? Draw the ordinary diagrams with draw card diagrams superimposed for the following cases: (a) normal case, firing properly timed, (b) early firing, (c) late firing. Explain the effect of (b) and (c) on the working of the engine. Show the effect of after-burning on an indicator diagram.

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CONTENTS.

No.	PAGE
Department of Transport (Marine Division).	
GOVERNMENT NOTICE.	
R. 735. Examinations for Engineer-Officers: Regulations ...	1

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