

FIG. 1.—FLEET SCHOOL ORGANIZATION, H.M.C.S. 'STADACONA'

R.C.N. ENGINEERING TRAINING

H.M.C.S. STADACONA

BY

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Introduction

Two previous articles associated with R.C.N. engineering training have been published in this *Journal*. In January, 1957, (Vol. 10, No. 1) the reorganized trade structure of the R.C.N. was explained. The June, 1958 (Vol. 11, No. 2) edition included an article showing the Engineering Branch training throughout the R.C.N.

This article is confined to an explanation of the training carried out in the Engineering Division of H.M.C.S. *Stadacona*, Halifax, Nova Scotia.

Fleet School

Prior to 1960 the Officer-in-Charge of the Engineering Division (M.T.E. as it was then called) was directly responsible to the Commodore, R.C.N. Barracks. The organization was then altered to have the Officers-in-Charge of Divisions responsible to the Fleet School Training Officer who is in turn responsible to the Commodore (see FIG. 1). This has resulted in obtaining common policies, routines etc. within all the Divisions of the Fleet School.

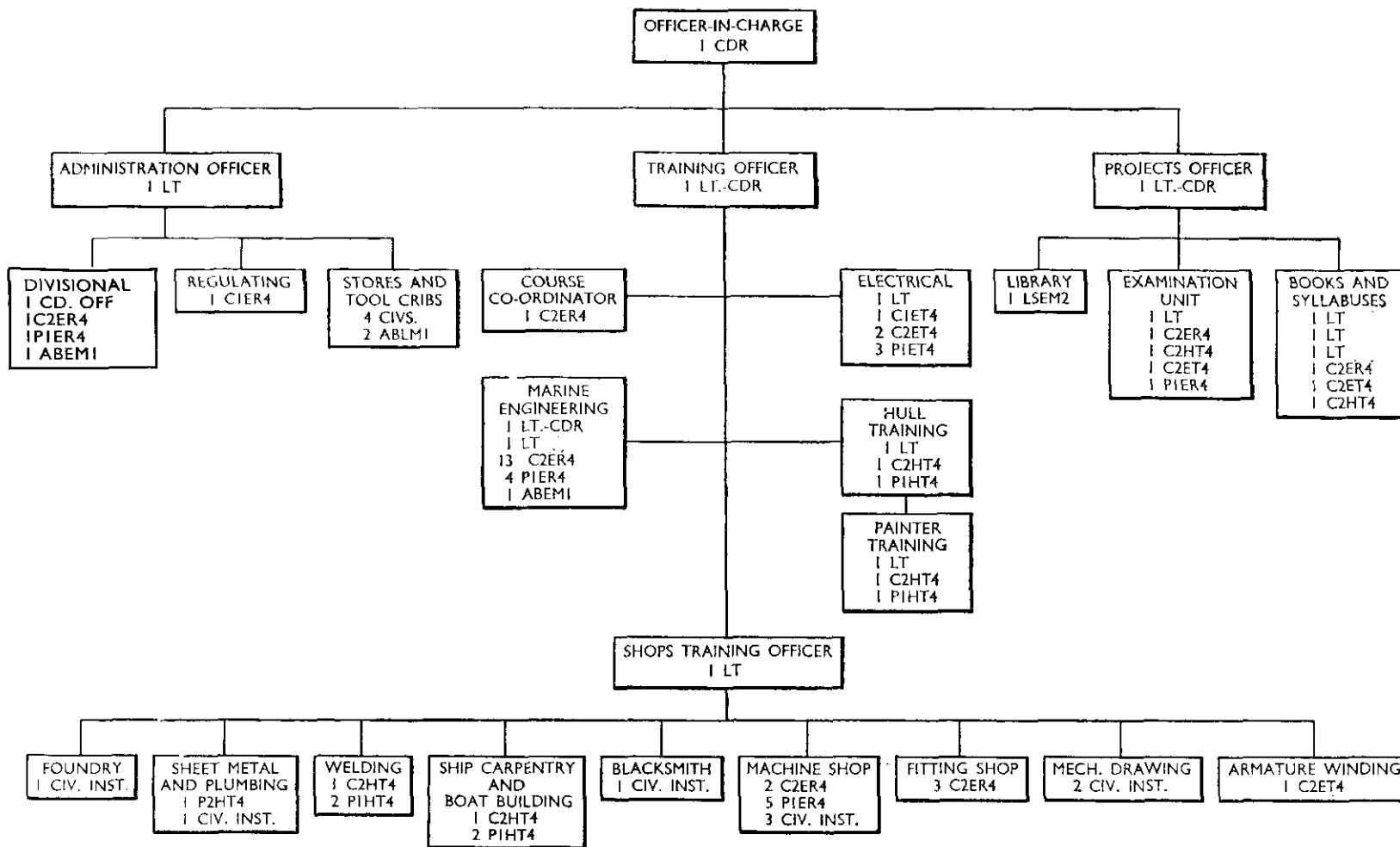


FIG. 2—ENGINEERING DIVISION—INTERNAL ORGANIZATION AND COMPLEMENT

H T : Hull Technician
E T : Engineering Technician

Engineering Division

The organization within the Division is shown in FIG. 2. The three main areas of responsibility are as follows :—

- (a) Administrative Section
 - (i) The administration of the General Office
 - (ii) Regulating Office
 - (iii) Divisional work
 - (iv) Sports
 - (v) All stores and tool cribs
 - (vi) Cleanliness and repair of all buildings
 - (vii) Security and preservation of good order and discipline
 - (viii) All work orders and non-training activities in the shops.
- (b) Projects Section
 - (i) Writing of course notes and syllabuses
 - (ii) Examinational procedures
 - (iii) Liaison with the Fleet to obtain information on improvements and modification in equipment
 - (iv) Conducting staff planning and staff placement
 - (v) Library and reference material.
- (c) Training Section
 - (i) Standard and execution of training within the syllabuses supplied by the Projects Officer
 - (ii) Course scheduling
 - (iii) Visiting fleet and repair facilities to improve theoretical and practical course instruction.

Promotion and Advancement

Training to any particular level of knowledge, is governed to a large degree by the procedure for promotion and advancement. The rank and trade group of a man determine the responsibility which he bears and hence the knowledge and training he requires. Before an examination is made of the training which is given within the Engineering Division, the procedure for promotion and advancement will be explained.

Promotion

The minimum requirements for promotion within the engineering trade are shown in FIG. 3, and a brief outline of the Trade Groups and Certificates noted in this diagram is given below :—

- (a) T.G.1—No longer a formal course but acquired at sea on completion of the 18-week new entry training which is common to all trades and held at H.M.C.S. *Cornwallis*. The examination for T.G.1 is set by the Naval Examination Centre and a man must complete his practical factors before being allowed to write.
- (b) T.G.2—Course of 20 weeks duration given at the Engineering Division, H.M.C.S. *Stadacona*.
- (c) T.G.3—Course of 44 weeks duration, given at the Engineering Division, H.M.C.S. *Stadacona*.
- (d) T.G.4—Course of 40 weeks duration, given at the Engineering Division, H.M.C.S. *Statdacona*.
- (e) Certificate 3A, B or C (E.R. W/K Cert.)—awarded by the E.O. of the ship and dependent upon the type of main machinery. (3A—turbine, 3B—reciprocating, 3C—I.C.E.)

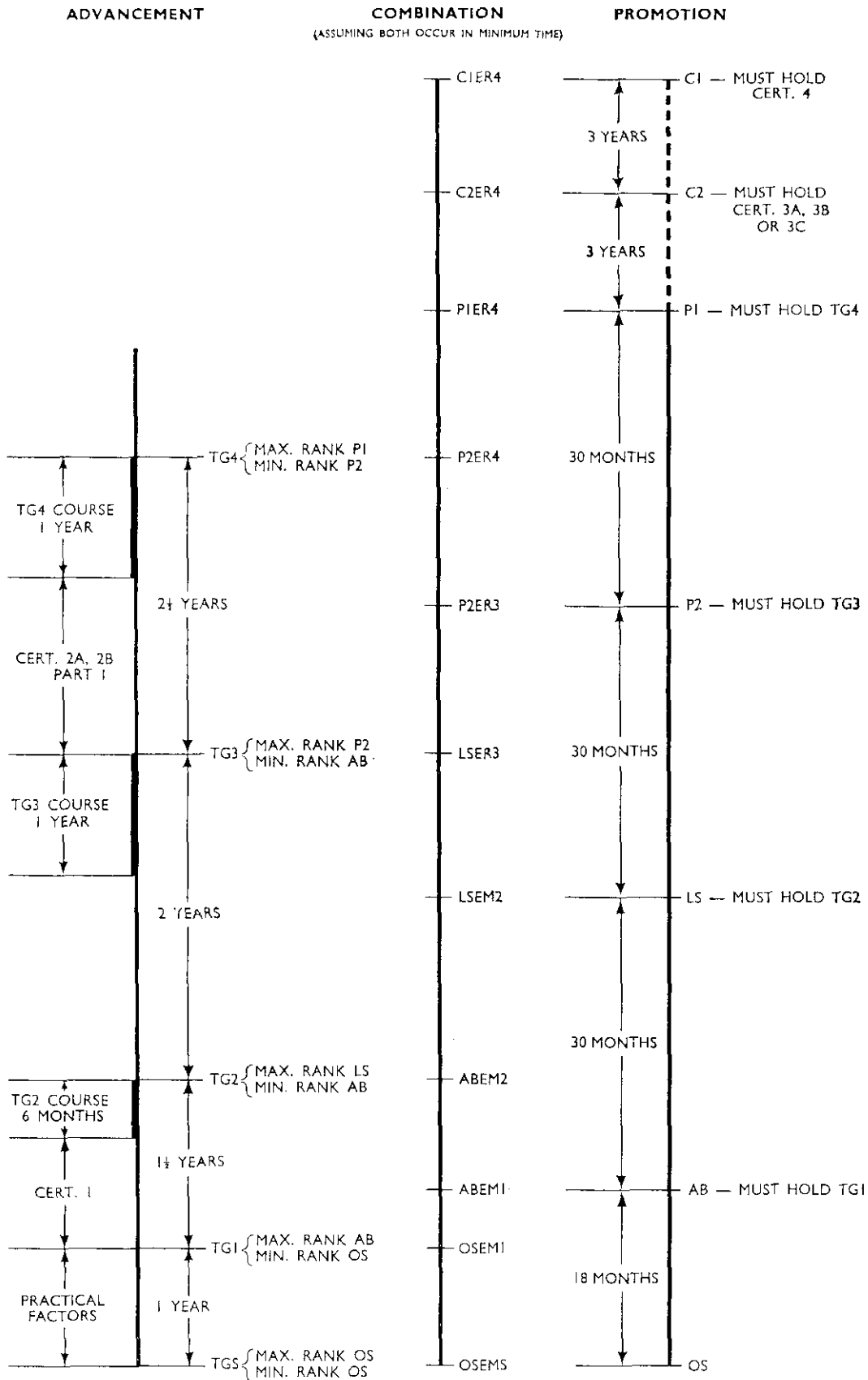


FIG. 3—MINIMUM REQUIREMENTS FOR PROMOTION AND ADVANCEMENT WITHIN THE ENGINEERING TRADE

Note : (a) Only the following requirements are shown : (i) Rank (ii) Trade Group (iii) Certificates (iv) Time in rank or Trade Group

(b) The sea time requirement is one year for every promotion and advancement, except for TGS to TGI and OS to AB where the sea time requirement is six months

- (f) Certificate 4, Parts 1 and 2 (Charge Certificate)—A written and oral examination given in two parts by a board convened at the Engineering Division, H.M.C.S. *Stadacona*.

When a man has completed the minimum requirements for a particular rank, he will become one of a group of men within his trade who are in the promotion zone. To rate these men in an order for promotion when a vacancy occurs within that rank, a composite score is calculated. This calculation is done in Naval Headquarters every half-year.

The composite score is based on a total of 400 points allocated as follows :—

- (a) Performance evaluation—200 points
- (b) Service time—40 points
- (c) Education—20 points
- (d) Time in rank following entry into promotion zone—40 points
- (e) Special contributions—40 points
- (f) Rank examination—60 points.

A brief explanation of these is as follows :—

- (a) Performance Evaluation : Rendered by man's immediate supervisor and signed by the Divisional Office, C.O. and the man being evaluated. The object is to identify the degree of competence that individuals display in the performance of their duties. For the L.S. and A.B. seven areas of performance are evaluated and each given a rating. For the P2, P1, C2 and C1 six areas of performance are evaluated and ratings are made from 1 to 10.
- (b) Service Time : Must be continuous, unbroken full time R.C.N. regular force service.
- (c) Points are awarded for various courses which will not be listed here.
- (d) Based on the number of months a man is in the promotion zone.
- (e) Not used at the present time.
- (f) Rank examinations will commence to be a requirement for promotion in 1962 and will be based upon rank specifications. Before a man will be allowed to write the rank examination he will have to demonstrate his ability by performing certain duties and tasks. This he will do by completing the practical factors laid down for his particular rank in his trade.

After calculation, the composite score is used to adjust each man's position on the promotion roster, and when a vacancy occurs within his trade the man at the top of the roster is promoted.

Specifications

The required knowledge and skill for any trade group or rank is prepared by Naval Headquarters and listed in specifications. Each specification lists the requirements for any particular trade group or rank under four headings.

<i>Trade Group</i>	<i>Rank</i>
(1) Operation	(1) Military and General Ship/Establishment duties
(2) Maintenance	(2) Discipline and Welfare
(3) Administration/Clerical	(3) Administration and Clerical
(4) Instruction	(4) Instruction

Under each heading is given the particular duties associated with the rank or trade and the knowledge, skill or technique demanded at that particular level. Throughout the specifications, the levels of skill and knowledge are fixed by the use of the following adjectives :—

Adjectives used to Describe Knowledge

Basic—

First level—Rudimentary, introductory. Requires some specialized knowledge or experience which can be acquired through a relatively short period of on-the-job training or very limited formal training

Detailed—

Second level—With particulars, working. Requires a substantial amount of specialized knowledge that necessitates formal training and/or considerable practical experience in order to perform duties efficiently

Comprehensive—

Third level—Of wide scope. Depth of knowledge in particular field or breadth of knowledge in a large number of fields of activity. Requires a high degree of knowledge of relatively complex theories, techniques or administrative procedures, a large fund of specialized information and extensively practical experience to adequately cope with diversity of situations

Complete—

Fourth level—Thorough. Having no part lacking in a particular sphere of activity. Requires a thorough knowledge of all techniques and procedures to fulfil the requirement in one sphere of activity and a firm understanding of their integration into other specialized fields of endeavour necessitating extensive formal training and practical experience

Adjectives used to Describe Skill

Limited Skill—

First level—Requires little manual or mental dexterity and/or co-ordination in the performance of simple tasks using basic tools or operating equipment. This level of skill can be developed through on-the-job training

Semi-Skilled—

Second level—Partially skilled, can do routine tasks. Not necessarily experienced in operating equipment under all operational conditions. Has been given theory in use of tools and administrative procedures but has limited practical experience. Requires a moderate degree of dexterity and/or co-ordination which can be developed, through formal and/or practical experience.

Skilled—

Third level—Experienced practical man. Able to do difficult tasks using the tools and/or equipment of his trade under any conditions. Requires a substantial degree of dexterity and/or co-ordination acquired through formal training and/or practical experience

Highly Skilled—

Fourth level—Capable of performing the most complicated tasks, and operating equipment of his trade under all conditions. Requires the highest degree of accuracy, dexterity and/or co-ordination necessary for difficult or precise assembly operations, administrative tasks or other activities at this level

FIG. 4—DEFINITIONS OF THE FOUR LEVELS OF KNOWLEDGE AND SKILL REQUIRED TO PERFORM THE VARIOUS DUTIES AND TASKS LAID DOWN IN RANK AND TRADE SPECIFICATIONS

<i>Knowledge</i>	<i>Skill</i>
(1) Basic	(1) Limited Skill
(2) Detailed	(2) Semi-Skilled
(3) Comprehensive	(3) Skilled
(4) Complete	(4) Highly Skilled

These adjectives are defined in FIG. 4 and an example of the layout for rank and trade specifications is shown in FIG. 5.

Advancement

Apart from Trade Group courses, other requirements for men of the Engineering trade are as follows :—

(a) *Practical Factors*

Required before being allowed to write the T.G. I examination. The list of practical factors includes a number of tasks which the man must perform satisfactorily during his on-the-job training period at sea. These tasks are carried out during his normal duties and witnessed by his immediate supervisor, e.g. he must demonstrate his ability to flash, operate and shut down a sprayer on a steaming boiler.

Part of the Rank Specification for a Petty Officer 1st Class

4. <i>Instruction</i>	<i>Knowledge, Skill, Techniques</i>
1. May be required to give classroom instruction to trade groups 1, 2 and 3 of the trade	1. Detailed knowledge of instructional techniques. Complete knowledge of training syllabuses
2. Organizes and gives on-the-job instruction in P2 and below duties	2. Complete knowledge of rank requirements for P2 and below
3. Checks 'practical requirements' for P2	3. Complete knowledge of practical requirements for P2 and performance standards

Part of the Trade Specification for Engineering Technician Trade Group 3—ER 3

3. <i>Administration/Clerical</i>	<i>Knowledge, Skill, Techniques</i>
1. Prepares engineering stores and spare parts records	1. Comprehensive knowledge of spare parts routines procedures and allowance lists. Skilled in the identification, preservation upkeep and stowage of all departmental spare parts
2. Plans and organizes preventive and corrective maintenance ; forecasts need for spare parts, permanent and consumable stores	2. Highly skilled in naval methods of scheduling work and forecasting material requirements. Comprehensive knowledge of material demanding, accounting and issuing procedures as applied to his department
3. Prepares drawings and supporting data for any proposed mechanical modification	3. Semi-skilled in mechanical drawing. Detailed knowledge of naval reports and returns peculiar to his department

FIG. 5—EXAMPLES OF RANK AND TRADE SPECIFICATIONS

(b) *Certificate 1 (Aux. W/K Certificate)*

Obtained at sea after reaching T.G. 1 and awarded by the E.O. of the ship. Is a requirement for commencing the T.G. 2 course.

(c) *Certificate 2A Part 1 (Boiler Room W/K Certificate)*

Obtained after T.G. 3 course and awarded by the Engineer Officer of the ship. Is a requirement before commencing T.G. 4 course. Certificate 2B Part 1 is the I.C.E. equivalent.

When men are selected to commence course they must re-engage should they have too little time left to serve after the course has been completed.

Trade Courses

The content and level of these courses is based upon the requirements laid down in the trade specifications.

Each syllabus is drawn up by the Engineering Division from the specifications and divided into phases, units and lessons. It is then provisionally approved by Naval Headquarters and finalized after its validity has been proved by experience.

Phase

A major division of a course devoted to closely related subject matter.

Lesson

A division of a unit embracing a single topic.

Lesson Outline

An organized guide of a single lesson topic used as a guide for the instructor in preparing his lesson plan.

Lesson Plan

Derived from lesson outline and is instructor's own plan for the presentation of the particular lesson topic.

An example of the division between a phase, unit and lesson is shown and for this particular lesson two periods have been allocated as shown by (2).

EM 2 Course

Phase : 4-00 Boilers

Unit : 4-02 Admiralty 3-drum Boiler

Lesson : 4.02/1 (2) General description.

The amount of time devoted to particular phases and units for the T.G. 2, 3 and 4 courses is shown in the Appendix to this article.

A brief explanation of each course is as follows :—

- (a) Trade Group 2—Aims at acquainting the trainee with all types of machinery he is likely to operate and provide knowledge which will equip him to be able to carry out simple maintenance. No main propulsion machinery is taught and only fitting shop projects are made during the Workshop Phase. There are still some leading hands who have not taken this course. Eventually the course can be expected to only contain A.B.s who have obtained Certificate 1 before the course. Courses commence every month.
- (b) Trade Group 3—Contains a more detailed explanation of the construction and maintenance of the machinery taught in T.G. 2. Machining is taught in the Workshop Phase for the first time. During the ship refit phase the trainee works under supervision on ships undergoing self-maintenance or in refit. Also during this period he will spend one week in an auxiliary vessel to gain Diesel running experience. At this moment both P2s and LSs are taking this course. Eventually the trainees on this course will only be LSs. It will be possible for an A.B. to take the course but unlikely because of the methods used in selecting men for trade courses. Courses commence every two months.
- (c) Trade Group 4—This course first commenced in April, 1961, and as from January, 1962, it will be the only means of obtaining T.G. 4. Up until then it had been possible to obtain T.G. 4 by obtaining the part (2) of the Certificate 2A or 2B (Boiler Room or I.C.E. W/K Certificate). P2s who take this course will have obtained Certificate 2A Part 1 (Boiler Room W/K Certificate) before commencing this course.

The technical apprentice will have been promoted to P2ER3 when he successfully completes his Technical Apprentice Training Course. Having obtained Certificate 2A Part 1 he will now take this T.G. 4 course except for the academic and workshop phases which he will not be required to take.

Examination

Examinations are written in each phase with the marks obtainable being based on a ratio of 100 marks per week of instruction. The requirements to pass a course are (a) 50 per cent in each phase (b) 60 per cent in the overall average. Should a trainee fail a phase he is required to write a supplemental and must pass this examination. Should he fail three phases he is declared a course failure and is returned to sea. After a period of one year, 18 months or two years, according to whether the course he failed was T.G. 2, 3, or 4 (respectively), he may return for a second attempt. This is his last occasion for formal training in this course and should he fail he can only then advance by his own efforts or self-study.

Advancement Roster

While there are vacancies in the Trade Group a man is advanced immediately on completion of course. When there are no vacancies a roster will be kept. Men will enter the roster in class order on completion of course. Once on the roster their position can only be altered by men coming off the roster to fill a vacancy. Their performance evaluation assessment will not affect their position on the roster. One effect of this will be that a man's class position will become more important to him since the higher he finishes in his class the sooner he will come off the roster and be advanced.

Other Courses

Courses other than those for men of the engineering trade are not described in this article. Refresher courses which may be taken by men of the engineering trade are promulgated to the Fleet every month and are as follows :—

- (a) Bailey Meter Course—three days duration—construction, operation and simple maintenance
- (b) Bailey Meter maintenance course—two weeks duration for key personnel only
- (c) Refrigeration—three days duration for personnel who have had little practical experience
- (d) Maxim evaporators—one day course
- (e) Vapour Clarkson Boiler—one day course.

Instructors

All members of the staff undergo an instructional technique course of three weeks duration on arrival in the division. Their working load is assessed for the purposes of divisional complement as 35 weeks per year. Taking away annual leave this gives each instructor a load of some three weeks of instruction per month.

Instructors are assigned to one particular phase which is headed by a CI. Within this phase they may be required to teach at the T.G. 2, 3 or 4 level.

Workshop instructors will eventually be provided at the rate of one instructor to seven men in the class, but at the moment it is not possible to do this. Classes for the T.G. 2 course are normally not above 20 men, and for the T.G. 3 and 4 courses not normally above 15 men.

Instructors may be P1, C2, or CIs, except for the officers' courses which are normally taught by officers. The other exception to this is with the Engineering Science Phase which is instructed by officers and taken in the Academic Division.

Conclusions

Of the many changes which have taken part within the last two years the following may be noted with their advantages to both the man and the R.C.N.:

- (1) Reduction in initial engagement from five to three years—Men have an earlier opportunity to withdraw from the service or give a vote of confidence and sign on.
- (2) On-the-job training to obtain T.G. 1—This enables the average to above-average man to obtain a better grounding of knowledge before his first formal course. The below average man by not receiving formal instruction will probably not fare as well under this type of training.
- (3) Introduction of T.G. 4 course for the engineering trade—This will result in a far better trained T.G. 4 man.

APPENDIX

NO. OF PERIODS FOR EACH PHASE IN TG2, 3 AND 4 COURSE

Unit	Phase 1.00—Engineering Science	Number of Periods		
		TG2	TG3	TG4
1.01	Arithmetic	70	—	—
1.02	Algebra	35	35	40
1.03	Graphs	—	—	20
1.04	Trigonometry	—	—	20
1.05	Statics	—	—	16
1.06	Kinetics	18	15	26
1.07	Strength of Materials	6	—	15
1.08	Hydrostatics and Hydraulics	7	40	20
1.09	Elements of Buoyancy and Stability	—	—	14
1.10	Heat	21	15	25
1.11	Thermodynamics	18	28	—
1.12	Metallurgy	—	7	34
1.13	Corrosion	—	—	15
	Total No. of Days	25	20	35
Unit	Phase 2.00—Mechanical Drawing	Number of Periods		
		TG2	TG3	TG4
2.01	Basic Procedures	—	14	15
2.02	Free-hand Sketching	—	4	5
2.03	Applied Geometry and Developments	—	—	21
2.04	Drawing Projects	—	44	34
2.05	Blue Print Reading	—	6	3
2.06	Sections, Conventions and Revolutions	—	—	26
2.07	Auxiliary Views	—	—	9
2.08	Pipes and Welding	—	—	10
2.09	Gears	—	—	20
	Total No. of Days	—	10	21
Unit	Phase 3.00—Workshops	Number of Periods		
		TG2	TG3	TG4
3.01	Moulding Shop	—	21	—
3.02	Sheet Metal Shop	—	35	—
3.03	Machine Shop	—	175	297
3.04	Fitting Shop	105	105	—
3.05	Trade Test	—	70	53
	Total No. of Days	15	58	50
Unit	Phase 4.00—Boilers	Number of Periods		
		TG2	TG3	TG4
4.01	Development in Boiler Design	—	—	8
4.02	Admiralty 3-Drum Boiler	25	27	4
4.03	Babcock and Wilcox controlled S/H Blr.	24	29	7
4.04	Combustion	—	21	11
4.05	Boiler Mountings	—	34	10

Continued on next page

<i>Unit</i>	<i>Phase 4.00—Boilers (contd.)</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
4.06	Examination, Cleaning Preservation	14	29	10
4.07	Conditions Affecting Efficiency	—	—	6
4.08	Auxiliary Boilers	21	—	5
4.09	Bailey Meter Controls and Systems	14	30	70
4.10	Bricking	21	—	—
4.11	Operational Trouble and Emergencies	—	—	3
	Total No. of Days	18	25	20
<i>Unit</i>	<i>Phase 5.00—Main Propulsion</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
5.01	Thermodynamics	—	—	25
5.02	Thermod. applied to Recip. Engines	—	—	7
5.03	Thermod. applied to Turbines	—	—	21
5.04	The 4-Cylinder, Triple-Exp. Recip. Eng.	—	20	22
5.05	Main Turbines and Condensers	—	21	29
5.06	Gearing Shafting	—	14	14
5.07	Propellers—Outboard Shafting and Components	—	6	8
5.08	Trials	—	2	7
	Total No. of Days	—	10	20
<i>Unit</i>	<i>Phase 6.00—Auxiliary Machinery</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
6.01	Auxiliary Turbines	—	—	10
6.02	Reciprocating Pumps	6	30	—
6.03	Centrifugal Pumps	3	41	16
6.04	Positive Displacement Pumps	3	8	4
6.05	Axial Flow Pumps	2	8	4
6.06	Evaporators	16	—	18
6.07	Turbo Generators	16	—	9
6.08	Forced Draught Fans and Turbo Blowers	3	18	5
6.09	Air Compressors	7	—	9
6.10	Refrigeration	7	29	28
6.11	Steering Gear	12	—	10
6.12	Electrical Procedures and Precautions	4	—	—
	Total No. of Days	12	20	17
<i>Unit</i>	<i>Phase 7.00—Systems</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
7.01	Steam and Exhaust	4	—	14
7.02	Feed Water	17	6	18
7.03	F.F.O. and Diesel Fuel	8	8	16
7.04	Lubrication	8	25	14
7.05	Sea Water Cooling	3	—	5
7.06	Fresh Water	3	4	4
7.07	Insulation and Lagging	14	—	1
7.08	Packing and Jointing Materials	3	—	—
7.09	Aviation Fuels	—	—	7
	Total No. of Days	10	7	12

<i>Unit</i>	<i>Phase 8.00—Diesels</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
8.01	Introduction and Principles	6	9	6
8.02	Diesel Construction—Stationary Parts	6	6	6
8.03	Diesel Construction—Moving Parts	19	16	6
8.04	Engine Systems	14	23	6
8.05	Controls and Transmissions	22	10	11
8.06	Operation and Trials	12	6	7
8.07	Maintenance and Repair	—	14	21
8.08	Practical Operation	12	14	14
	Total No. of Days	15	15	12
<i>Unit</i>	<i>Phase 9.00—Administration and Training</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
9.01	Administration and Publications	2	3	7
9.02	Planned Maintenance	7	9	8
9.03	Defect Lists—A.s and A.s	—	—	6
9.04	Command and Dockyard Organization	—	—	10
9.05	Naval Stores	7	9	6
9.06	Training	14	21	13
	Total No. of Days	5	7	8
<i>Unit</i>	<i>Phase 10.00—Ship Refit</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
10.01	Ship Refit—Shop Work	—	35	—
10.02	Ship Refit—With Fleet	—	280	—
	Total No. of Days	—	45	—
<i>Unit</i>	<i>Phase 11.00—Docking, Refit, New Construction</i>	<i>Number of Periods</i>		
		<i>TG2</i>	<i>TG3</i>	<i>TG4</i>
11.01	Docking	—	—	10
11.02	Refit	—	—	4
11.03	New Construction	—	—	12
	Total No. of Days	—	—	4

Note: No. of periods per day 7

No. of working days per week 5

Time for review and examinations has not been shown.