QUALITY CONTROL IN NAVAL REFITS

BY

B.M. ZIEGLER, C.Eng., A.M.I.Mar.E., M.R.I.N.A.

Presented to a combined meeting of
THE ROYAL INSTITUTION OF NAVAL ARCHITECTS (AUST. BRANCH)
and
THE INSTITUTE OF MARINE ENGINEERS (SYDNEY BRANCH)
on Wednesday 20th September, 1972

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PREAMBLE -

In the repair and refit of the Australian OBERON Class Submarine, the refitting contractor, Vickers Cockatoo Dockyard Pty. Limited, is required to provide quality assurance through a quality control organisation.

The formation and introduction of a new department into a well established organisation such as one involved in ship repair and ship construction on a reasonably large scale, can be fraught with difficulties. It is here that I am prompted to quote Dr. John E. Condon, Director, Reliability and Quality Assurance, N.A.S.A., who said "Why is it so appallingly difficult to put across something that is so extremely simple". The smooth establishment of the new department, channelling it into all existing departments concerned, engendering confidence that "what they never had before" is what is now needed, is a task by no means small.

The purpose of this paper is to outline the background leading up to the establishment of the Quality Control Organisation at Vickers Cockatoo, to briefly describe the organisation and to illustrate important features and some teething problem aspects of note which arise in the application of such a new activity - together with what must be the biggest single hurdle to be overcome in a ship-building and repair yard of long and good repute - the hurdle of the human attitude.

INTRODUCTION -

The primary function of any quality control organisation is to ensure that the specified standards of manufacture or repair have been met, and, where called for, to provide assurance of quality to the customer. To achieve the necessary level of quality the customers' requirements must from the outset be specified clearly and completely, and the contractors Q.C. organisation must not only be comprehensive on paper, but strong operationally. All concerned must have a clear understanding of what the function of each department is and must respect the individual responsibilities of those departments.

Understanding of the concept of quality with regard to control and assurance is essential. The quality of any product is the measure of excellence of that product in relation to the specified requirements. The contractor must achieve the specified requirements, i.e. provide a product, the quality of which is as requested. No more, no less, than to exercise adequate Quality Control. Additionally the contractor must be capable of providing by means of the Q.C. organisation, documentary evidence or proof that the product does meet the requirements. In doing so, time and money factors cannot be excluded, and the biggest single requirement to achieve these aids must be the right human attitude to the task.

In warships, damage control affects everybody in the ships company. Road safety is the concern of all motorists. Similarly, Quality Control affects everyone in the Contractors team. It is difficult to lay down a precise definition to quality control. The usual definition is "Quality Control is the function or collection of duties which must be performed throughout an organisation in order to achieve its quality objectives", but it needs to go further than that and probably the best definition is "Quality Control is a management system for co-ordinating the quality maintenance and improvement efforts of the various groups so as to enable production to function at the most economic levels which will allow for full customer satisfaction". In another way, it can be said that Quality

Control is a production tool which aids the process of ensuring that the customer gets what he wants, when he wants it and at the right cost.

Control of quality dates back hundreds of years. In the reign of Edward III (14th centruy) Wardens of the Crafts were appointed to ensure that "it may be seen that work be good and right, and to reform what defects they shall find therein and inflict due punishment on the offender". Quality in shipbuilding and ship repair is not new. Shipyards world wide for ages have taken pride in delivery of quality ships. The degree, consistency and economics of that quality are, however, matters which until comparatively recently were not given the attention which we now see as essentially warranted. The need for quality control systems in shipbuilding and repair has arisen through the gradual increase since World War II in the complexity of ships systems/equipments, the introduction of new materials and the requirement for very long operational cycles. In particular the advent of the nuclear submarine construction programme in U.S.A. and U.K. has given greater emphasis to the need for quality control. Finally the need for even stricter controls is forcibly driven home, regrettably, for instance by the "Thresher" disaster, and many other lesser calamities involving system failures, the latter seemingly incidental but embarrassing and sometimes close to calamity.

The very nature of ship repair and shipbuilding work poses problems in the application of Quality Control which would not normally be encountered in the mass production field. It might be said that here is the reason why Quality Control is a late comer to the dockyards, since the mass production field offers the more ideal approach for Quality Control application which in that field has been operating for about 50 years. Although in general the principles are the same the projects in shipyards are more than likely to be "one off" and infrequently may be "two or more off." Each repair, refit or build project in itself encompasses periods of from 2 months for short refits up to 4-5 years for large construction projects.

Each comprises units, systems, equipments all of which in the main are different to each other. A "one off" construction job of a certain type may not recur. Regular Naval visitors for main refits have operational cycles extending up to 4 years. It thus takes considerable time to accrue a library of statistical data useful for Quality Control purposes, as opposed to the early availability of trends in mass production. The approach to Quality Control application is unique to any industry (in varying degrees), and to the shipbuilding/ship repair field it is even more so.

The field of application in this case is to a dockyard which by its nature of geographic location is unique in itself, but also unique with regard to its control and role. Thus a brief on Cockatoo is important here.

The dockyard is owned by the Commonwealth of Australia and operated under lease by Vickers Cockatoo Dockyard Pty. Limited (a company of the Vickers group). The main activities of the dockyard are Naval Shipbuilding, Naval refits covering all types of surface vessels, submarine refits (the latter being a continuous single stream project, for which modern facilities have recently been provided) general commercial engineering, and merchant ship repairs and dockings.

Since the company took control of the dockyard in 1933, 29 Naval and 6 Merchant vessels, of up to 15000 Tons have been constructed. The current major refit work is submarine refitting, each submarine receiving a thorough and complete overhaul, each refit duration being approximately 14 months.

For Naval work the customers 'agent' is the General Overseer and Superintendent of Inspection, East Australia Area. He has been locally represented at the Dockyard by the Principal Naval Overseer (and staff) for the past 33 years.

Until recently the validity of all naval work to specification

and drawing was endorsed, as appropriate, by the Naval Overseers. Under such circumstances it must be conceded that there was a tendency for the contractor to lean somewhat more than lightly, on the overseers. This is to say that because of the existance of the Naval Overseeing team who ensured themselves that work was completed to drawing and specification, the contractor was inclined to leave Quality Assurance to the overseers. The introduction and development of a contractors Quality Control Organisation therefore relieves the overseeing staff of these inspection functions and additionally provides a comprehensive documentary assurance. The function of Naval Overseers in the future will be to assure themselves of the adequacy of the contractors functions by a process of auditing.

In 1967 the Department of the Navy indicated that in view of the increased complexity and tighter specifications of modern Submarine design, coupled with the need for the highest standards of safety and reliability, that it was the intention to make Quality Control a requirement for Submarine main refits. It was appreciated that an organisation of this nature would require a gradual build up and that additional staff would be required. The aim was to have a viable organisation ready for the commencement of the first OBERON Class Submarine refit, due to commence early 1971. At this stage, 1967, Navy advised that a specification defining the general requirements and the extent of application would be given in due course.

Later in 1968 the Navy specification known as the General Requirements of a Contractors Quality Control Organisation was received for consideration and comment and in 1970 approval was given to proceed with the build up of the organisation. Then came the task of recruiting suitable staff and producing documentation to meet the commencement of the first submarine refit. Indoctrination, above all, had to be carried out.

An indication of the volume of work required to produce preparatory Q.C. documentation for a submarine main refit, is

illustrated by the fact that some 2000 applicable items are required to be surveyed in order to assess the work content. Take into account check sheets, acceptance records, pressure test forms, dimensional records, shop test records, ship test records and additionally all records to do with stores and raw material receipt inspection, and the number quickly runs to the high five figures. Additionally special procedures are required to be written, and all these actions must be to a standardised and Q.A.A. approved form.

The use of copies of Vickers (Barrow-in-Furness) documentation and other U.K. yards was, and continues to be, of great guidance value in building up the organisation, notwithstanding the fact that the major portion of this information is for construction and not for refit work.

At the start of the first OBERON Class Submarine Main Refit in April 1971, an organisation had been set up and was ready to function in accordance with Navy requirements.

CONTRACTORS Q.C. SPECIFICATION

The Navy requirements are set down in what is known as the General Requirements of a Contractors Quality Control Organisation. In brief this specification requires the contractor to establish a Q.C. organisation to ensure compliance with appropriate contracts by:

(a) ensuring that the required levels of quality are maintained.

(b) making readily available objective evidence of quality, to the Quality Assurance Authority.

(c) effectively controlling purchased materials/goods and sub-contract work.

(d) evaluating quality problems, initiating, recommending or providing solutions.

(e) appreciating that the fulfillment of the specification is the responsibility of the contractor and not of any single department or person.

(f) maintaining complete and reliable records, not only for assurance purposes in each contract, but for the purpose of analysis as a basis for management action.

(g) ensuring that the quality aspects of, for example, purchasing, handling, machining, assembling, processing, inspection, testing, modification, installation, etc., are clearly specified.

(h) quickly detecting and correcting conditions adverse to quality.

(i) providing adequate receipt inspection to materials/goods to ensure conformance to physical, chemical and other technical requirements as appropriate.

APPLICABILITY

I have earlier stated that it was appreciated that the organisation would require a gradual build up. It was considered that any effort to attemp 100% Quality Control coverage to the first project would be a formidable task for a newly set up team, in this relatively new field of quality assurance for refits. Therefore the Navy requirements stipulated that initially the Quality Control coverage would be to certain applicable items of equipments/systems. This applicability would be increased for each subsequent refit on a gradual scale so that eventually 100% coverage was achieved. At the current rate full coverage will be given in 1974.

Those equipments/systems included in the 1971-72 Submarine Main Refit applicability list for Quality Control coverage embraced areas which were vital to safety. For example, Pressure Hull work would be given Quality Control Coverage in the first instance rather than say, main engines.

The applicability statement also included the requirement that work carried out at Sub-contractors premises would remain the responsibility of the Naval Overseeing and Inspection Branch.

Any belief that a contractors Q.C. applicability to nominated areas, coupled with Naval Overseeing and Inspection, for the remaining areas, is a split responsibility for quality, is invalid. The quality specification calls for a formalised Q.C. Organisation to cover nominated areas. But, the specification "in no way limits the Contractor's responsibility for the satisfactory performance of the contract", and it follows that for ALL work, quality is the <u>contractors</u> business and responsibility whether he is required to provide assurance of quality for the items nominated as Q.C. applicable or not.

As stated above the current policy is that applicability will be increased to ultimately give full Q.C. coverage. In doing so we must be very careful to weigh up the economics of providing assurance of quality "across the board". At present a fully 'applicable' item/equipment/system etc., is one which is subject to the quality specification, i.e. assurance of quality must be provided. There is much work which can be safely left with the production departments and need not have the added expense to the customer of quality assurance documentation. Such areas are furniture, panelling, upholstery, floor coverings etc.

THE CHALLENGE

Consider now the challenge - a Quality Control Organisation is required to be set up and to operate (initially on a limited applicability basis) in a ship building and repair yard which for 33 years has worked on the basis that as far as Naval work was concerned assurance of quality rested with the customer. Suddenly a drastic change. What do the foreman, chargehands, the men on the shop floor think of the injection of a Quality Control system, the sudden appearance of documentation, records to be filled in, Quality Control staff in white overalls with clipboards and pencils. How do they react to the reference to Quarantine, Reject, Concession?

One aims of course to achieve success in early lectures aimed at winning the confidence of the men who build in quality, by giving them such a clear picture of the requirements, the reasons, and the part they have to play, that all will be smooth sailing, and each job will be right first time, without fail. But it is a laborious and time consuming process, and rewards come slowly.

Early and careful indoctrination is vital. But it takes time. Changing the attitudes (albeit exemplary over the period) which have existed for 33 years takes more than introductory lectures. It takes plain, honest, down to earth experience, but even that will not be a success unless it is coupled with a strong Quality Control team, who know exactly what the task is and how to get the message across. All reasonable avenues must be used, including appeal by posters. (See Figure (1)).

There is no doubt that there is a tendency for the man on the shop floor to think that because we now have Quality Control, some of his responsibility has been taken away. We must dispel this fallacy and ensure that the responsibility for quality rests on everyone.

HENRY VIII HAD SIX ATTEMPTS

C A A C J C

OUR AIM RIGHT FIRST TIME

ISSUED BY Q.C.D.

Fig. 1

It is easy to see that long accepted attitudes cannot be changed overnight. Consider the requirements prior to Quality Control looming up over the horizon. Signatures were not normally required to certify the various stages of work done. They always 'did it right' and mainly this would be true. Why then, all this paperwork and even more careful inspection. What did they do wrong. Nothing really. The work was specified by the customer who carried out a series of inspections to satisfy himself that all was well. There was little or no paperwork. The amount of re-work necessary to achieve this type of assurance of conformance was not known. Much good advice was given throughout the job by the overseer. The shops came to rely on the customers advice and overseeing which perhaps tended to develop into supervision. But what was advised as acceptable this time may not be the same advice next time. Where inabilities to meet certain specified requirements arise decisions on alternative dimensions or materials are made verbally - again, the same situation at a later date may bring forth a different decision. In short it is a fairly cosy existance which has without doubt produced many fine end products. But, like everything else, it is each small error which is made that matters, it passes unnoticed until much later when rectification becomes many times as costly and time consuming. Worse still it is the small built in error which remains undetected until reliability or safety in service is affected.

How then can production personnel be convinced that they are being assisted in their work, that Quality Control is a production tool, that they need to be provided with special information and that signatures are required to certify work done to specification? In other words that compliance with procedures is now mandatory where previously inspection alone was sufficient.

At least one answer lies in understanding that prior to the introduction of Quality Control 'inspection' referred to measuring, examining and testing without systematic documentation and without a formal means to cure the ills potential to such inspection. Certainly inspection is a safeguard against defective equipment

getting into service, but it simply ACCEPTS or REJECTS. But any process which allows for rejection, rather than aiming to prevent it, is clumsy. Continuous quality cannot be 'inspected' into a job, it can only be built in. The inspection aspect must be seen as just one element of Quality Control which aims, through its various functions to eliminate rejection, and, rework. It follows that this approach is not only rewarding in quality achieved, but economically as well.

There are other aspects which must be considered. It is necessary to allay any suspicion that Q.C. Officers are "policemen" acting as a brake to efficient production by the rigid application of unnecessarily high standards. Quality requirements can be brought into disrepute by insisting on too high a standard, and where these are seen to be too high rationalisation must be made. It is equally as important of course, to ensure that no short cuts which would result in a lowering of standards, are allowed.

THE ORGANISATION AT VICKERS COCKATOO

The arrangement of any Q.C. Organisation is to some extent dictated by the conditions already existing in any shipyard but more importantly the form it takes depends on the type of vessels being refitted or under construction, and the amount of assurance required. The departmental chart shown at Figure 2 is given as a guide to the existing arrangement at Vickers Cockatoo.

The chart shows an arrangement which was drawn up initially for submarine refits and has since had the new construction leg added. Hence the Q.C. Engineers in this arrangement are involved in all the aspects of Quality Control, including:-

preparation of procedures - auditing compliance with
preparation of Q.C. forms,

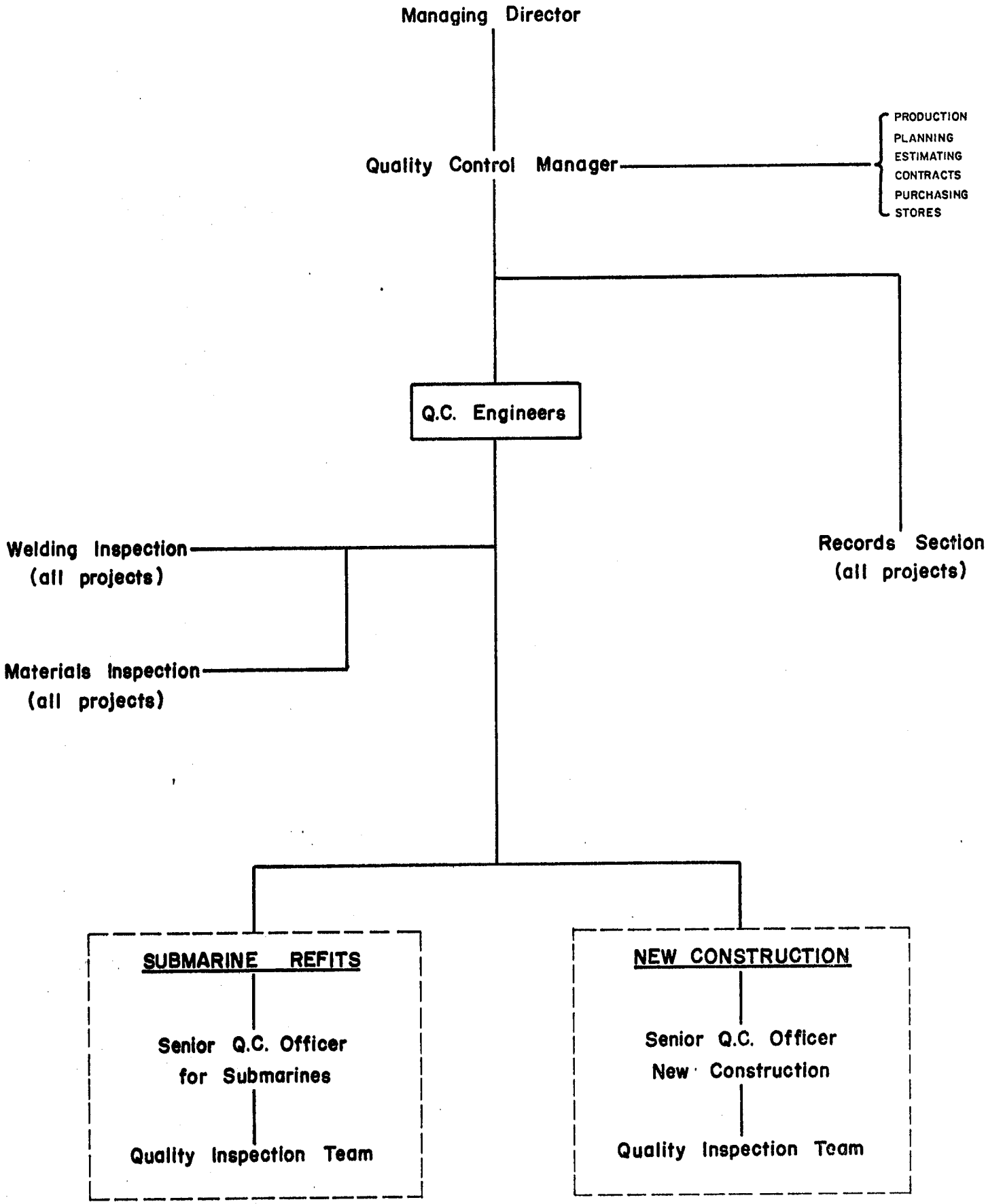

Managing Director
Quality Control Manager
PRODUCTION
PLANNING
ESTIMATING
CONTRACTS
PURCHASING
STORES
Q.C. Engineers
Welding Inspection
(all projects)
Materials Inspection
(all projects)
Records Section
(all projects)
SUBMARINE REFITS
Senior Q.C. Officer
for Submarines
Quality Inspection Team
NEW CONSTRUCTION
Senior Q.C. Officer
New Construction
Quality Inspection Team

Fig. 2

checking completed Q.C. forms,

action on Concessions, Deficiency and Corrective Action reports

examination of quality problems in repair, construction, receipt inspection, raw materials etc.

feed back information to other departments

production measuring and calibration equipment

and they are responsible for the various activities of the welding and materials Q.C. Officers, and the Q.C. personnel on day to day inspection activities. Co-ordination within the Q.C. Engineers responsibilities tends to be difficult under these circumstances, but the single project covered (the main refit of a submarine) and the nature of that project did not lend itself to a broader form of organisation. It must be remembered that the Submarine refit project was the first attempted with a Q.C. Organisation, and particularly that the Q.C. Personnel in the field were treading new ground, and so to a certain extent was production. It was considered necessary therefore to have a combined team of 'experts' at the Q.C. Engineer level, carefully watching all aspects.

A somewhat broader approach is now envisaged. (Figure 3). Here a quality engineering section is established in order that the important task of writing procedures, arranging for and analysing audits, examining requests for concessions etc., can be given the effort warranted in those respects. Additionally, expansion to inspection at sub-contractors premises requires a special section to cover sub-contracts, purchase orders and materials/goods receipt inspection.

The organisation is, of course not confined to the Quality Control Department alone. The definition of quality control given earlier is quite clear in this regard - "the function or collection of duties which must be performed throughout the organisation....". Written procedures form the basis for the requirements to be observed for all the important processes. These procedures may require to be very comprehensive but in many cases can be confined to a sample check sheet. The Quality Control Department issues the procedure, the production department (and/or other departments concerned) is required to comply, and the Quality Control Department audits that compliance, taking appropriate actions which will lead to assurance of quality.

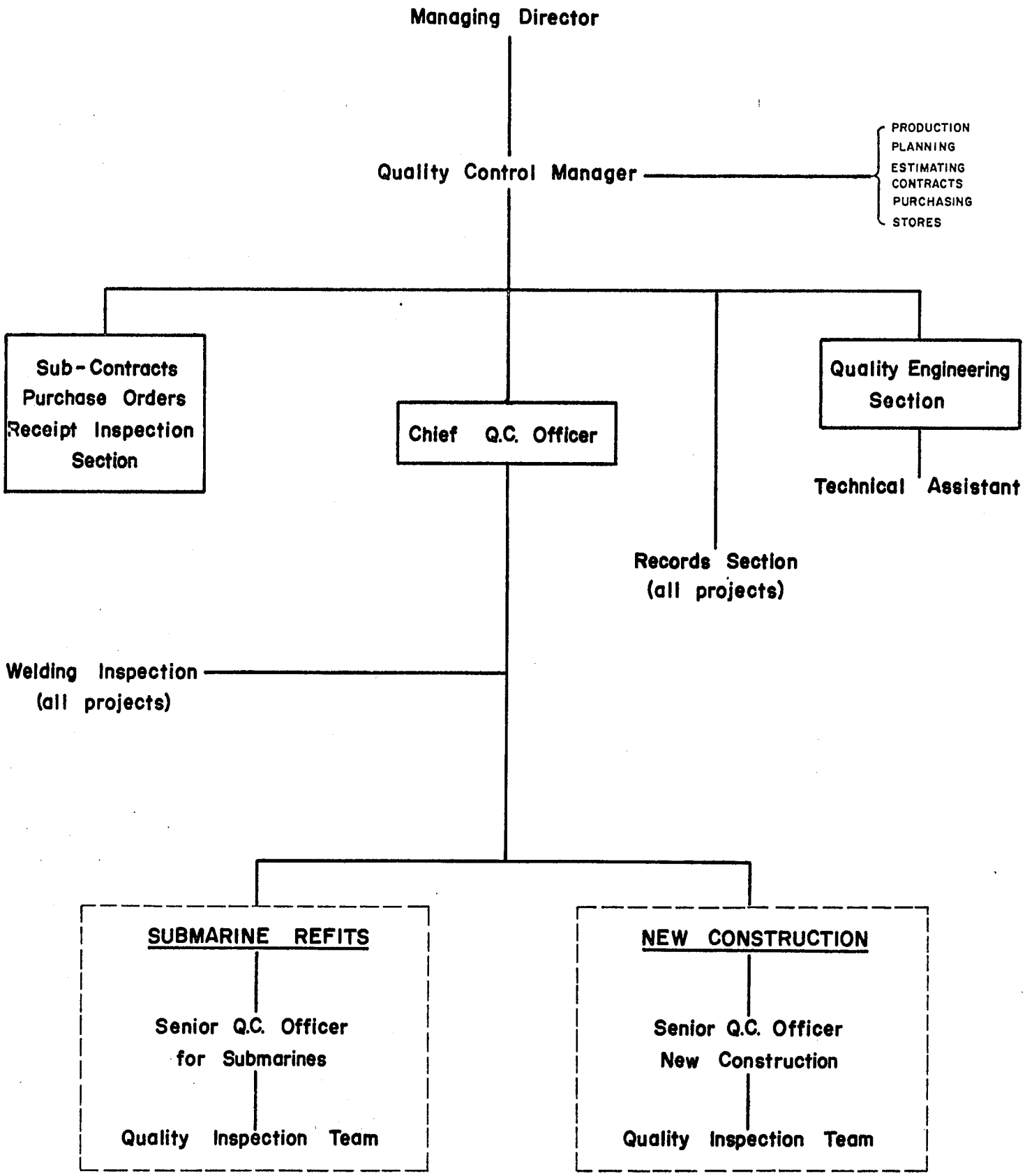

Managing Director
Quality Control Manager
PRODUCTION
PLANNING
ESTIMATING
CONTRACTS
PURCHASING
STORES
Sub-Contracts
Purchase Orders
Receipt Inspection
Section
Chief Q.C. Officer
Quality Engineering
Section
Technical Assistant
Records Section
(all projects)
Welding Inspection
(all projects)
SUBMARINE REFITS
Senior Q.C. Officer
for Submarines
Quality Inspection Team
NEW CONSTRUCTION
Senior Q.C. Officer
New Construction
Quality Inspection Team

Fig. 3

It is important for instance to have a procedure to cover the quality aspects of purchase orders, for receipt inspection, for the welding of special steels, and so on. Only in this way can the various special tasks be controlled.

Thus the activities of the Quality Control Department involves all those departments which are concerned with shop manufacture and repair, afloat and dockwork, shipyard construction processes, metrology, physical and chemical testing, subcontract, purchasing, stores, functional testing, planning, estimating and so on.

DOCUMENTATION

It is not intended to elaborate on all the documentation required in detail. A complete description of the ramifications of a system which is concerned with many thousands of details about surveys, pressure tests, functional tests, acceptances etc., would surely be pointless. It is however, important to stress that Q.C. inspection and auditing, culminating in documentary evidence for assurance purposes, must be carefully planned and executed. The continuous aim in this regard must be to minimise paper work without detriment to the job being "right first time" and without detriment to the ability to produce the quality assurance documentation required by the customer. It must also be borne in mind that until such time as all concerned are able to fully recognise the importance of quality control, the volume of documentation is necessarily more than required, and the effort required by the Q.C. Department greater than it should be. This is simply illustrated, for instance, in purchase order control. A thoroughly efficient organisation would entail an audit procedure only, but where attributes and variables are being scrutinised by a newly formed outside department it follows that until a degree of confidence is reached the surveillance effort will initially be large, but gradually decreases as the ordering expertise grows and confidence increases.

Refitted equipments/systems/parts

The extent of quality documentation is dependent on nature of each item under refit. Checks must be made at each stage of refit work, from stripping out through to reassembly and reinstallation whether for pumps, motors, pipework, valves, switchboards, tanks or the many other items involved. Over the refit of a ballast pump, for instance the following documentation would be processed:-

(a) Dimensional Inspection (opening and closing)
(b) Survey
(c) Check Sheet
(d) Pressure Test
(e) Shop Test
(f) Ship Test - (after installation inspection)

Under straightforward refitting the abovementioned documents when completed comprise the quality assurance pack. The pack may expand, however, to include a concession request or deficiency and corrective action report, and in all cases would be finalised by an acceptance inspection certificate.

Documentation in other refitting aspects includes where appropriate, paintwork inspection, noise and vibration measurements, shock and vibration mounts inspection, dynamic balancing records and many others.

For ship construction purposes the requirements for documentation must necessarily be adjusted to suit.

Deficiency & Corrective Action

Of particular interest and one of the most important aspects of the Quality Control activities is the "Deficiency and Corrective Action" procedure. Reference has been made to an inspection system which simply accepts or rejects. This could be called a final inspection system, where deviations cannot be controlled, let alone minimised. The importance of close control on deviations has been stressed in other papers (Quality Control in the Shipbuilding

Industry - E. Hunter, The Development of Quality Control in Shipbuilding - T. Christie. C.Eng. 1970) and is clearly recognised. Errors, inaccuracies, deviations or departures of any kind from drawings and specifications, by inadvertence, carelessness, misdirection or whatever cause, are costly and can have serious consequences if early detection is not possible. Compliance with the requirement to report deviations, at source, is essential, if success in this important aspect is to be achieved. I quote from Mr. Hunter's paper referred to above "Any Shipyard which is willing to set up this procedure will be amazed by the number of deficiencies shown up". Using the quality slogan, he was right first time! It is amazing.

The procedure is simple, and requires anyone in production or inspection to raise each significant problem on a Defect Advice Note, giving appropriate identification and location. Some may not require the Deficiency and Corrective action process, because they are minor, the standard required is not affected, and can be dealt with 'on the spot', but the record remains - these may show up to be repetitive and action can be taken accordingly. Where investigation is required for Corrective Action the appropriate Quality Engineer raises the Deficiency and Corrective Action report, showing the full deficiency and recommending appropriate action. Authorisation for the work to be done is given after concurrence by the customer (where applicable) and/or Technical Services. Typical examples are shown at Figure 4 and 4A.

It is interesting once again to look back at the system without quality control. Corrective actions made? Yes. But when? How many? By whom? For what reason? There was no record. What then is the reaction to a formal Deficiency and Corrective Action procedure, or a Quarantine or any other reasonable procedure not previously introduced. Oddly enough there is a tendency for some to say that progress is slowed by these new innovations. This is a fallacy. Deficiencies, for example, are now highlighted, brought out into the open. All those who should know of the deficiency, do know, and

VICKERS
COCKATOO DOCKYARD
PTY. LIMITED

COCKATOO ISLAND
SYDNEY N S W 2000
TELEPHONE 82 0661

QUALITY CONTROL

DEFICIENCY & CORRECTIVE ACTION REPORT

COPY ONLY

SHIP / JOB	———	PURCHASE ORDER No.	-	JOB No.	3000
DEFECTIVE PART	TAILSHAFT - PORT			ITEM No.	1103N
ITEM IN SYSTEM	MAIN SHAFTING			E.D.P. No.	110/9/1
LOCATION IN SHIP	AFT.	PRESENT LOCATION	TURBINE SHOP	CUSTOMERS ORDER No.	-
DRAWING No.	163P-4202-001	SERIAL No.	200	DATE CORRECTION IS REQUIRED	-
* SOURCE OF SUPPLY	~~COCKATOO DOCKYARD~~ / DEPT. OF NAVY / ~~SUB-CONTRACTOR~~				
* APPARENT RESPONSIBILITY	COCKATOO DOCKYARD/ ~~DEPT. OF NAVY / SUB-CONTRACTOR~~				

DEFICIENCY:

REFERENCES: (i) Q.C. Survey Report SUR/110/9/1 issued 9/7/71

(ii) T.S.M. amendments 211 and 436

This shaft has been built up by welding in way of the stern tube bearing and gland areas, straightened, stress relieved and finish machined to design dimensions.

Results of a straightness check after finish machining are as follows:

The maximum run out on that section of the shaft aft. of the gland area is 0.007" T.I.R., which is acceptable, however the readings on the coupling taper are as follows:

LARGE END OF TAPER 0.008" T.I.R.

SMALL END OF TAPER 0.033" T.I.R.

If the coupling is fitted in this condition a whip would be induced in the shaft in way of the gland.

P.T.O.

TYPE OF DEFECT	
PURCHASE ORDER	
DESIGN	
MATERIAL SHORTAGE	
FAULTY WORK	#
INSTALLATION DAMAGE	
PRE INSTALL'N DAMAGE	
LOST ITEMS	
FAILED TEST	
DAMAGED TEST	
NORMAL WEAR	
MATERIAL FAULT	

REPORTED BY:	(Sgd.) Gauger	DEPT.	Metrology	DATE	14/2/72
Q.C. SURVEYOR	(Sgd.) Q.C. Engineer (M)	DATE	23/2/72	* DELETE WHERE NOT APPLICABLE	

Q.C. FORM 035

D & CA No. 74

VICKERS COCKATOO DOCKYARD PTY. LIMITED

H.M.A.S. ———

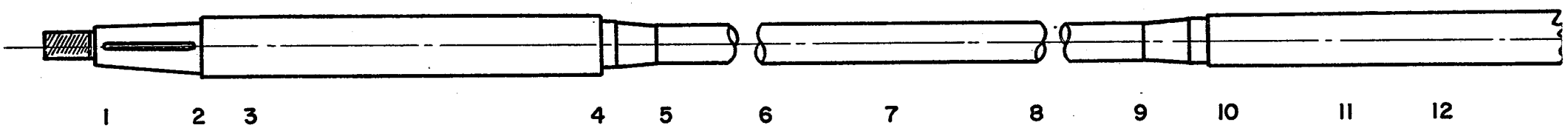
SHAFT No. 200

DATE 14 / 2 / 1972

.001" Units T.I.R.

PORT / ~~STARBOARD~~

EDP 110 / 9 /



POS. / ANGLE	1	2	3	4	5	6	7	8	9	10	11	12	13
0°	←				Set to zero								→
96°	+1	+1	0	0	+1		+4		-4	+1	0	+1	-1
180°	+7	+7	+4	0	+4		+1		0	0	-1	+1	-3
270°	+1	+1	0	-1	+3		-2		-1	0	0	0	-3
				*							*		

* ROLLER

GAUGER ———

Q.C. REPRESENTATIVE ———

~~QUAL.~~ CNTL. ENGR. — MECH.

VICKERS
COCKATOO DOCKYARD
PTY. LIMITED

COCKATOO ISLAND
SYDNEY N S W 2000
TELEPHONE 82 0861

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QUALITY CONTROL

DEFICIENCY & CORRECTIVE ACTION REPORT

SHIP / JOB	———	PURCHASE ORDER No.	-	JOB No.	3000
DEFECTIVE PART	COUNTERMEASURE TUBES, REAR DOORS			ITEM No.	8653J
ITEM IN SYSTEM	SWINGBOLT, HINGE FITTINGS			E.D.P. No.	851/7 & 8
LOCATION IN SHIP	AFTER ENDS	PRESENT LOCATION	ONBOARD	CUSTOMERS ORDER No.	-
DRAWING No.	U.L. 347	SERIAL No.		DATE CORRECTION IS REQUIRED	-
* SOURCE OF SUPPLY	~~COCKATOO DOCKYARD / DEPT. OF NAVY / SUB-CONTRACTOR / VENDOR~~				
* APPARENT RESPONSIBILITY	~~COCKATOO DOCKYARD~~/ DEPT. OF NAVY / ~~SUB-CONTRACTOR / PENDING~~				

DEFICIENCY:

The bolts in the hinges of the swingbolts on both Countermeasure Rear Doors cannot be withdrawn. The bolts, approx. 8" long, are installed to be withdrawn vertically upwards but after about 5" of travel foul the table of Frame 115.

TYPE OF DEFECT	
PURCHASE ORDER	
DESIGN	##
MATERIAL SHORTAGE	
FAULTY WORK	
INSTALLATION DAMAGE	
PRE INSTALL'N DAMAGE	
LOST ITEMS	
FAILED TEST	
DAMAGED TEST	
NORMAL WEAR	
MATERIAL FAULT	

REPORTED BY:	(Sgd) Q.C. Officer	DEPT.	Q.C. Dept	DATE	20/9/71
Q.C. SURVEYOR	(Sgd) Q.C. Engineer (H)	DATE	20/9/71	* DELETE WHERE NOT APPLICABLE	

Q.C. FORM 035

Fig. 4A

D. & C.A. No. 26

appropriate actions for rectification are taken, as well as long term action to prevent re-occurrence. The earlier system did not highlight these matters, and resultant unawareness at correct level gave a false impression of the volume of work required.

Many investigations and corrective actions have been taken to date on the one project in hand. Assuming satisfactory progress in control of quality the number of such actions taken should gradually diminish to the minimal over each successive project. This is the aim.

We are now able to categorise deficiencies, concessions and quarantine actions, analyse the causes, advise the appropriate departments responsible, and this does not exclude the customer. Can we afford to do otherwise?

RECEIPT INSPECTION AND ASSOCIATED DOCUMENTATION

Receipt inspection of parts, goods, equipments etc., covers a vast range and cannot be satisfactorily achieved by the Quality Control Department alone. With full co-operation from the Stores Department, and the ordering departments concerned, good coverage can be given. Here again, the goods emanate from two sources. On the one hand company purchased items can be satisfactorily controlled only if it is ensured that the order placed contains details of attributes and variables, which are specified in such a manner that the right item will be received. Receipt Inspection of Navy Supplied 'in aid' items is limited generally to detect damage in transit and for completeness and proper type.

Raw Materials

The simple aim of control of quality in raw materials is to ensure that only those materials which meet the specified requirements for the job concerned are allowed into the production line.

Provision by the provider of adequate test certificates and identity of such certificates to the related material for all orders received would require physical and chemical analyses to be taken on a batch sampling basis only, i.e. there would be a minimal number of tests. Regrettably this is not the case. Raw materials receipt at Vickers Cockatoo is from two sources, commercial and Navy Supplier. No difficulty is experienced in commercial orders for large quantities, but where small quantities are required say, from local stockists, there is little hope of getting test certificates except, but not always, by additional cost to the order. Careful purchase order control can however overcome this problem.

A considerable quantity of raw materials supplied are from Naval sources. Experience to date has shown that 100% physical and chemical tests are required to be performed on receipt, as test certificates and proof of identity cannot yet be made available.

The percentage rejection is low, but until such time as certification becomes more the rule than complete exception, the costly and time consuming tests must continue. Typical sample analysis examples are shown at Figure 5 and 5A.

It is interesting to note that on more than one occasion raw materials which have been quarantined as a result of test on receipt, and then returned to supplier, have been received at a later date as a result of a new order to the same specification - with our quarantine label still attached!

Quarantine

If ever a word frightens anyone quarantine seems to do just that, and yet the selection of the title "Quarantine Store" for Quality Control purposes, could not be better.

Ideally, the most effective way to ensure that only the right materials/goods are released to production after receipt is to have