

## REPORT ON STEAM RECIPROCATING ENGINE MACHINERY.

Received at London Office

Date of writing Report 22/5/1943 When handed in at Local Office 22/5/1943 Port of WEST HARTLEPOOL  
 No. in Survey held at WEST HARTLEPOOL. Date, First Survey 22<sup>nd</sup> Sept, 1942, Last Survey 15<sup>th</sup> May, 1943.  
 Reg. Book. on the STEEL SCREW STEAMER "EMPIRE STALWART" (Number of Visits 75)  
 Built at WEST HARTLEPOOL By whom built WM. GRAY & CO. LTD. Yard No. 1147 Tons { Gross 7044.60  
 Engines made at WEST HARTLEPOOL. By whom made CENTRAL MARINE ENG. WORKS. Engine No. 1147. When built 1943.  
 Boilers made at WEST HARTLEPOOL. By whom made CENTRAL MARINE ENG. WORKS. Boiler No. 1147. When made 1943.  
 Registered Horse Power — Owners MINISTRY OF WAR TRANSPORT. Port belonging to WEST HARTLEPOOL.  
 Nom. Horse Power as per Rule 510. Is Refrigerating Machinery fitted for cargo purposes No. Is Electric Light fitted Yes.  
 Trade for which Vessel is intended OCEAN GOING.

ENGINES, &c.—Description of Engines Inverted triple expansion  
 Dia. of Cylinders 24½ x 39 x 70 Length of Stroke 48" No. of Cylinders 3 Revs. per minute 76  
 Crank shaft, dia. of journals as per Rule 13.99" as fitted 14¼" Crank pin dia. 14¼" Crank webs Mid. length breadth 21" No. of Cranks 3  
 Intermediate Shafts, diameter as per Rule 13.32" as fitted 13⅝" Thrust shaft, diameter at collars as per Rule 13.99" as fitted 14¼"  
 Tube Shafts, diameter as per Rule — as fitted — Screw Shaft, diameter as per Rule 14.84" as fitted 15¼" Is the { tube } shaft fitted with a continuous liner { Yes }  
 Bronze Liners, thickness in way of bushes as per Rule .753" as fitted .812" Thickness between bushes as per Rule .56" as fitted 21/32" Is the after end of the liner made watertight in the propeller boss Yes. If the liner is in more than one length are the junctions made by fusion through the whole thickness of the liner One length.  
 If the liner does not fit tightly at the part between the bearings in the stern tube, is the space charged with a plastic material insoluble in water and non-corrosive —  
 If two liners are fitted, is the shaft lapped or protected between the liners — Is an approved Oil Gland or other appliance fitted at the after end of the tub shaft No. If so, state type — Length of Bearing in Stern Bush next to and supporting propeller 5-1"  
 Propeller, dia. 18-3" Pitch 16-6" No. of Blades 4 Material CAST IRON whether Moveable No. Total Developed Surface 110. sq. feet  
 Feed Pumps worked from the Main Engines, No. — Diameter — Stroke — Can one be overhauled while the other is at work —  
 Bilge Pumps worked from the Main Engines, No. 2 Diameter 4" Stroke 28" Can one be overhauled while the other is at work Yes.  
 Feed { No. and size 3 @ 9½ x 7 x 21 Single. Pumps connected to the { No. and size 2 @ 4 x 28" 1 @ 10 x 11 x 10 1 @ 9½ x 7 x 21"  
 Pumps { How driven Independent Steam. Main Bilge Line How driven Main Engines Independent Steam.  
 Ballast Pumps, No. and size 1 @ 10 x 11 x 10 Duplex. Lubricating Oil Pumps, including Spare Pump, No. and size —  
 Are two independent means arranged for circulating water through the Oil Cooler — Suctions, connected to both Main Bilge Pumps and Auxiliary  
 Bilge Pumps;—In Engine and Boiler Room 4 @ 3" 1 @ 5" In Pump Room In Holds, &c. No. 1, 2 @ 3" No. 2, 2 @ 3" No. 3, 2 @ 3" No. 4, 5 Blk. Rm.  
 2 @ 3" Eng. Rm. 2 @ 3" No. 5, 2 @ 3" No. 6, 1 @ 4" 2 @ 3" Tunnel well 1 @ 2½"  
 Main Water Circulating Pump Direct Bilge Suctions, No. and size 1 @ 9" Independent Power Pump Direct Suctions to the Engine Room Bilges, No. and size 1 @ 5"  
 Are all the Bilge Suction Pipes in holds and tunnel well fitted with strum-boxes Yes  
 Are the Bilge Suctions in the Machinery Space led from easily accessible mud-boxes, placed above the level of the working floor, with straight tail pipes to the bilges Yes  
 Are all Sea Connections fitted direct on the skin of the ship On reservoirs. Are they fitted with Valves or Cocks Both  
 Are they fixed sufficiently high on the ship's side to be seen without lifting the stokehold plates Yes. Are the Overboard Discharges above or below the deep water line Below.  
 Are they each fitted with a Discharge Valve always accessible on the plating of the vessel Yes. Are the Blow Off Cocks fitted with a spigot and brass covering plate Yes  
 What Pipes pass through the bunkers Bilge pipes to Forward Stolds. How are they protected Wood ceiling  
 What pipes pass through the deep tanks — Have they been tested as per Rule —  
 Are all Pipes, Cocks, Valves, and Pumps in connection with the machinery and all boiler mountings accessible at all times Yes  
 Is the arrangement of Valves and their connections such as to prevent the possibility of water passing from the sea or from water tanks into the cargo or machinery spaces, or from one compartment to another Yes Is the Shaft Tunnel watertight Yes. Is it fitted with a watertight door No. worked from —

MAIN BOILERS, &c.—(Letter for record S.) Total Heating Surface of Boilers 7,248 sq. ft.  
 Which Boilers are fitted with Forced Draft All Which Boilers are fitted with Superheaters All  
 No. and Description of Boilers 3 Single ended shell tubular Working Pressure 220 lbs.  
 IS A REPORT ON MAIN BOILERS NOW FORWARDED? Yes.  
 IS A DONKEY BOILER FITTED? No. If so, is a report now forwarded? —  
 Can the donkey boiler be used for domestic purposes only —  
 PLANS. Are approved plans forwarded herewith for Shafting 9-5-41 Main Boilers 19-2-41 Auxiliary Boilers — Donkey Boilers —  
 Superheaters General Pumping Arrangements Oil fuel Burning Piping Arrangements —

## SPARE GEAR.

Has the spare gear required by the Rules been supplied Yes.  
 State the principal additional spare gear supplied.

The foregoing is a correct description.  
 FOR THE CENTRAL MARINE ENGINE WORKS

(Sd. Eng &amp; Co. Ltd.)

John H. Frame  
 GENERAL MANAGER.

Manufacturer.

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Lloyd's Register  
 Foundation



1942. Sept. 22. Dec. 2. 1943. Jan. 25. 26. Feb. 2. 3. 4. 11. 13. 15. 18. 19. 20. 22. 23. 25. 26. March 1. 2. 3. 4. 5. 8. 9.  
During progress of work in shops - -  
10. 12. 13. 15. 18. 19. 23. 24. 27. 29. 30. 31. April 1. 2. 5. 7. 8. 9. 10. 13. 14. 15. 16. 19. 20. 21. 22. 23. 28. 29. May 3. 5. 6. 7. 1  
During erection on board vessel - - -  
1943. May 1. 11. 22. April 10. 13. 15. 16. 22. 27. May 1. 10. 11. 12. 15. 17. 27. 28. 29. 30. 31.  
Total No. of visits 73

Dates of Examination of principal parts—Cylinders 25-1-43-26-2-43 Slides 15-3-43 Covers 15-3-43  
Pistons 15-3-43 Piston Rods 15-3-43 Connecting rods 15-3-43  
Crank shaft 1-2-43-4-3-43 Thrust shaft 26-1-43-4-3-43 Intermediate shafts 10-3-43-29-3-43  
Tube shaft - Screw shaft 3-2-43-29-3-43 Propeller 29-3-43  
Stern tube 29-3-43 Engine and boiler seatings 22-3-43 Engines holding down bolts 27-4-43  
Completion of fitting sea connections 22-3-43  
Completion of pumping arrangements 10-5-43 Boilers fixed 27-4-43 Engines tried under steam 11-5-43  
Main boiler safety valves adjusted 10-5-43 Thickness of adjusting washers  $\frac{1}{16}$   $\frac{3}{16}$   $\frac{1}{4}$   $\frac{1}{2}$   $\frac{3}{4}$   $1$   $1\frac{1}{4}$   $1\frac{1}{2}$   $1\frac{3}{4}$   $2$   $2\frac{1}{4}$   $2\frac{1}{2}$   $2\frac{3}{4}$   $3$   $3\frac{1}{4}$   $3\frac{1}{2}$   $3\frac{3}{4}$   $4$   $4\frac{1}{4}$   $4\frac{1}{2}$   $4\frac{3}{4}$   $5$   $5\frac{1}{4}$   $5\frac{1}{2}$   $5\frac{3}{4}$   $6$   $6\frac{1}{4}$   $6\frac{1}{2}$   $6\frac{3}{4}$   $7$   $7\frac{1}{4}$   $7\frac{1}{2}$   $7\frac{3}{4}$   $8$   $8\frac{1}{4}$   $8\frac{1}{2}$   $8\frac{3}{4}$   $9$   $9\frac{1}{4}$   $9\frac{1}{2}$   $9\frac{3}{4}$   $10$   $10\frac{1}{4}$   $10\frac{1}{2}$   $10\frac{3}{4}$   $11$   $11\frac{1}{4}$   $11\frac{1}{2}$   $11\frac{3}{4}$   $12$   $12\frac{1}{4}$   $12\frac{1}{2}$   $12\frac{3}{4}$   $13$   $13\frac{1}{4}$   $13\frac{1}{2}$   $13\frac{3}{4}$   $14$   $14\frac{1}{4}$   $14\frac{1}{2}$   $14\frac{3}{4}$   $15$   $15\frac{1}{4}$   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$80\frac{3}{4}$   $81$   $81\frac{1}{4}$   $81\frac{1}{2}$   $81\frac{3}{4}$   $82$   $82\frac{1}{4}$   $82\frac{1}{2}$   $82\frac{3}{4}$   $83$   $83\frac{1}{4}$   $83\frac{1}{2}$   $83\frac{3}{4}$   $84$   $84\frac{1}{4}$   $84\frac{1}{2}$   $84\frac{3}{4}$   $85$   $85\frac{1}{4}$   $85\frac{1}{2}$   $85\frac{3}{4}$   $86$   $86\frac{1}{4}$   $86\frac{1}{2}$   $86\frac{3}{4}$   $87$   $87\frac{1}{4}$   $87\frac{1}{2}$   $87\frac{3}{4}$   $88$   $88\frac{1}{4}$   $88\frac{1}{2}$   $88\frac{3}{4}$   $89$   $89\frac{1}{4}$   $89\frac{1}{2}$   $89\frac{3}{4}$   $90$   $90\frac{1}{4}$   $90\frac{1}{2}$   $90\frac{3}{4}$   $91$   $91\frac{1}{4}$   $91\frac{1}{2}$   $91\frac{3}{4}$   $92$   $92\frac{1}{4}$   $92\frac{1}{2}$   $92\frac{3}{4}$   $93$   $93\frac{1}{4}$   $93\frac{1}{2}$   $93\frac{3}{4}$   $94$   $94\frac{1}{4}$   $94\frac{1}{2}$   $94\frac{3}{4}$   $95$   $95\frac{1}{4}$   $95\frac{1}{2}$   $95\frac{3}{4}$   $96$   $96\frac{1}{4}$   $96\frac{1}{2}$   $96\frac{3}{4}$   $97$   $97\frac{1}{4}$   $97\frac{1}{2}$   $97\frac{3}{4}$   $98$   $98\frac{1}{4}$   $98\frac{1}{2}$   $98\frac{3}{4}$   $99$   $99\frac{1}{4}$   $99\frac{1}{2}$   $99\frac{3}{4}$   $100$   $100\frac{1}{4}$   $100\frac{1}{2}$   $100\frac{3}{4}$   $101$   $101\frac{1}{4}$   $101\frac{1}{2}$   $101\frac{3}{4}$   $102$   $102\frac{1}{4}$   $102\frac{1}{2}$   $102\frac{3}{4}$   $103$   $103\frac{1}{4}$   $103\frac{1}{2}$   $103\frac{3}{4}$   $104$   $104\frac{1}{4}$   $104\frac{1}{2}$   $104\frac{3}{4}$   $105$   $105\frac{1}{4}$   $105\frac{1}{2}$   $105\frac{3}{4}$   $106$   $106\frac{1}{4}$   $106\frac{1}{2}$   $106\frac{3}{4}$   $107$   $107\frac{1}{4}$   $107\frac{1}{2}$   $107\frac{3}{4}$   $108$   $108\frac{1}{4}$   $108\frac{1}{2}$   $108\frac{3}{4}$   $109$   $109\frac{1}{4}$   $109\frac{1}{2}$   $109\frac{3}{4}$   $110$   $110\frac{1}{4}$   $110\frac{1}{2}$   $110\frac{3}{4}$   $111$   $111\frac{1}{4}$   $111\frac{1}{2}$   $111\frac{3}{4}$   $112$   $112\frac{1}{4}$   $112\frac{1}{2}$   $112\frac{3}{4}$   $113$   $113\frac{1}{4}$   $113\frac{1}{2}$   $113\frac{3}{4}$   $114$   $114\frac{1}{4}$   $114\frac{1}{2}$   $114\frac{3}{4}$   $115$   $115\frac{1}{4}$   $115\frac{1}{2}$   $115\frac{3}{4}$   $116$   $116\frac{1}{4}$   $116\frac{1}{2}$   $116\frac{3}{4}$   $117$   $117\frac{1}{4}$   $117\frac{1}{2}$   $117\frac{3}{4}$   $118$   $118\frac{1}{4}$   $118\frac{1}{2}$   $118\frac{3}{4}$   $119$   $119\frac{1}{4}$   $119\frac{1}{2}$   $119\frac{3}{4}$   $120$   $120\frac{1}{4}$   $120\frac{1}{2}$   $120\frac{3}{4}$   $121$   $121\frac{1}{4}$   $121\frac{1}{2}$   $121\frac{3}{4}$   $122$   $122\frac{1}{4}$   $122\frac{1}{2}$   $122\frac{3}{4}$   $123$   $123\frac{1}{4}$   $123\frac{1}{2}$   $123\frac{3}{4}$   $124$   $124\frac{1}{4}$   $124\frac{1}{2}$   $124\frac{3}{4}$   $125$   $125\frac{1}{4}$   $125\frac{1}{2}$   $125\frac{3}{4}$   $126$   $126\frac{1}{4}$   $126\frac{1}{2}$   $126\frac{3}{4}$   $127$   $127\frac{1}{4}$   $127\frac{1}{2}$   $127\frac{3}{4}$   $128$   $128\frac{1}{4}$   $128\frac{1}{2}$   $128\frac{3}{4}$   $129$   $129\frac{1}{4}$   $129\frac{1}{2}$   $129\frac{3}{4}$   $130$   $130\frac{1}{4}$   $130\frac{1}{2}$   $130\frac{3}{4}$   $131$   $131\frac{1}{4}$   $131\frac{1}{2}$   $131\frac{3}{4}$   $132$   $132\frac{1}{4}$   $132\frac{1}{2}$   $132\frac{3}{4}$   $133$   $133\frac{1}{4}$   $133\frac{1}{2}$   $133\frac{3}{4}$   $134$   $134\frac{1}{4}$   $134\frac{1}{2}$   $134\frac{3}{4}$   $135$   $135\frac{1}{4}$   $135\frac{1}{2}$   $135\frac{3}{4}$   $136$   $136\frac{1}{4}$   $136\frac{1}{2}$   $136\frac{3}{4}$   $137$   $137\frac{1}{4}$   $137\frac{1}{2}$   $137\frac{3}{4}$   $138$   $138\frac{1}{4}$   $138\frac{1}{2}$   $138\frac{3}{4}$   $139$   $139\frac{1}{4}$   $139\frac{1}{2}$   $139\frac{3}{4}$   $140$   $140\frac{1}{4}$   $140\frac{1}{2}$   $140\frac{3}{4}$   $141$   $141\frac{1}{4}$   $141\frac{1}{2}$   $141\frac{3}{4}$   $142$   $142\frac{1}{4}$   $142\frac{1}{2}$   $142\frac{3}{4}$   $143$   $143\frac{1}{4}$   $143\frac{1}{2}$   $143\frac{3}{4}$   $144$   $144\frac{1}{4}$   $144\frac{1}{2}$   $144\frac{3}{4}$   $145$   $145\frac{1}{4}$   $145\frac{1}{2}$   $145\frac{3}{4}$   $146$   $146\frac{1}{4}$   $146\frac{1}{2}$   $146\frac{3}{4}$   $147$   $147\frac{1}{4}$   $147\frac{1}{2}$   $147\frac{3}{4}$   $148$   $148\frac{1}{4}$   $148\frac{1}{2}$   $148\frac{3}{4}$   $149$   $149\frac{1}{4}$   $149\frac{1}{2}$   $149\frac{3}{4}$   $150$   $150\frac{1}{4}$   $150\frac{1}{2}$   $150\frac{3}{4}$   $151$   $151\frac{1}{4}$   $151\frac{1}{2}$   $151\frac{3}{4}$   $152$   $152\frac{1}{4}$   $152\frac{1}{2}$   $152\frac{3}{4}$   $153$   $153\frac{1}{4}$   $153\frac{1}{2}$   $153\frac{3}{4}$   $154$   $154\frac{1}{4}$   $154\frac{1}{2}$   $154\frac{3}{4}$   $155$   $155\frac{1}{4}$   $155\frac{1}{2}$   $155\frac{3}{4}$   $156$   $156\frac{1}{4}$   $156\frac{1}{2}$   $156\frac{3}{4}$   $157$   $157\frac{1}{4}$   $157\frac{1}{2}$   $157\frac{3}{4}$   $158$   $158\frac{1}{4}$   $158\frac{1}{2}$   $158\frac{3}{4}$   $159$   $159\frac{1}{4}$   $159\frac{1}{2}$   $159\frac{3}{4}$   $160$   $160\frac{1}{4}$   $160\frac{1}{2}$   $160\frac{3}{4}$   $161$   $161\frac{1}{4}$   $161\frac{1}{2}$   $161\frac{3}{4}$   $162$   $162\frac{1}{4}$   $162\frac{1}{2}$   $162\frac{3}{4}$   $163$   $163\frac{1}{4}$   $163\frac{1}{2}$   $163\frac{3}{4}$   $164$   $164\frac{1}{4}$   $164\frac{1}{2}$   $164\frac{3}{4}$   $165$   $165\frac{1}{4}$   $165\frac{1}{2}$   $165\frac{3}{4}$   $166$   $166\frac{1}{4}$   $166\frac{1}{2}$   $166\frac{3}{4}$   $167$   $167\frac{1}{4}$   $167\frac{1}{2}$   $167\frac{3}{4}$   $168$   $168\frac{1}{4}$   $168\frac{1}{2}$   $168\frac{3}{4}$   $169$   $169\frac{1}{4}$   $169\frac{1}{2}$   $169\frac{3}{4}$   $170$   $170\frac{1}{4}$   $170\frac{1}{2}$   $170\frac{3}{4}$   $171$   $171\frac{1}{4}$   $171\frac{1}{2}$   $171\frac{3}{4}$   $172$   $172\frac{1}{4}$   $172\frac{1}{2}$   $172\frac{3}{4}$   $173$   $173\frac{1}{4}$   $173\frac{1}{2}$   $173\frac{3}{4}$   $174$   $174\frac{1}{4}$   $174\frac{1}{2}$   $174\frac{3}{4}$   $175$   $175\frac{1}{4}$   $175\frac{1}{2}$   $175\frac{3}{4}$   $176$   $176\frac{1}{4}$   $176\frac{1}{2}$   $176\frac{3}{4}$   $177$   $177\frac{1}{4}$   $177\frac{1}{2}$   $177\frac{3}{4}$   $178$   $178\frac{1}{4}$   $178\frac{1}{2}$   $178\frac{3}{4}$   $179$   $179\frac{1}{4}$   $179\frac{1}{2}$   $179\frac{3}{4}$   $180$   $180\frac{1}{4}$   $180\frac{1}{2}$   $180\frac{3}{4}$   $181$   $181\frac{1}{4}$   $181\frac{1}{2}$   $181\frac{3}{4}$   $182$   $182\frac{1}{4}$   $182\frac{1}{2}$   $182\frac{3}{4}$   $183$   $183\frac{1}{4}$   $183\frac{1}{2}$   $183\frac{3}{4}$   $184$   $184\frac{1}{4}$   $184\frac{1}{2}$   $184\frac{3}{4}$   $185$   $185\frac{1}{4}$   $185\frac{1}{2}$   $185\frac{3}{4}$   $186$   $186\frac{1}{4}$   $186\frac{1}{2}$   $186\frac{3}{4}$   $187$   $187\frac{1}{4}$   $187\frac{1}{2}$   $187\frac{3}{4}$   $188$   $188\frac{1}{4}$   $188\frac{1}{2}$   $188\frac{3}{4}$   $189$   $189\frac{1}{4}$   $189\frac{1}{2}$   $189\frac{3}{4}$   $190$   $190\frac{1}{4}$   $190\frac{1}{2}$   $190\frac{3}{4}$   $191$   $191\frac{1}{4}$   $191\frac{1}{2}$   $191\frac{3}{4}$   $192$   $192\frac{1}{4}$   $192\frac{1}{2}$   $192\frac{3}{4}$   $193$   $193\frac{1}{4}$   $193\frac{1}{2}$   $193\frac{3}{4}$   $194$   $194\frac{1}{4}$   $194\frac{1}{2}$   $194\frac{3}{4}$   $195$   $195\frac{1}{4}$   $195\frac{1}{2}$   $195\frac{3}{4}$   $196$   $196\frac{1}{4}$   $196\frac{1}{2}$   $196\frac{3}{4}$   $197$   $197\frac{1}{4}$   $197\frac{1}{2}$   $197\frac{3}{4}$   $198$   $198\frac{1}{4}$   $198\frac{1}{2}$   $198\frac{3}{4}$   $199$   $199\frac{1}{4}$   $199\frac{1}{2}$   $199\frac{3}{4}$   $200$   $200\frac{1}{4}$   $200\frac{1}{2}$   $200\frac{3}{4}$   $201$   $201\frac{1}{4}$   $201\frac{1}{2}$   $201\frac{3}{4}$   $202$   $202\frac{1}{4}$   $202\frac{1}{2}$   $202\frac{3}{4}$   $203$   $203\frac{1}{4}$   $203\frac{1}{2}$   $203\frac{3}{4}$   $204$   $204\frac{1}{4}$   $204\frac{1}{2}$   $204\frac{3}{4}$   $205$   $205\frac{1}{4}$   $205\frac{1}{2}$   $205\frac{3}{4}$   $206$   $206\frac{1}{4}$   $206\frac{1}{2}$   $206\frac{3}{4}$   $207$   $207\frac{1}{4}$   $207\frac{1}{2}$   $207\frac{3}{4}$   $208$   $208\frac{1}{4}$   $208\frac{1}{2}$   $208\frac{3}{4}$   $209$   $209\frac{1}{4}$   $209\frac{1}{2}$   $209\frac{3}{4}$   $210$   $210\frac{1}{4}$   $210\frac{1}{2}$   $210\frac{3}{4}$   $211$   $211\frac{1}{4}$   $211\frac{1}{2}$   $211\frac{3}{4}$   $212$   $212\frac{1}{4}$   $212\frac{1}{2}$   $212\frac{3}{4}$   $213$   $213\frac{1}{4}$   $213\frac{1}{2}$   $213\frac{3}{4}$   $214$   $214\frac{1}{4}$   $214\frac{1}{2}$   $214\frac{3}{4}$   $215$   $215\frac{1}{4}$   $215\frac{1}{2}$   $215\frac{3}{4}$   $216$   $216\frac{1}{4}$   $216\frac{1}{2}$   $216\frac{3}{4}$   $217$   $217\frac{1}{4}$   $217\frac{1}{2}$   $217\frac{3}{4}$   $218$   $218\frac{1}{4}$   $218\frac{1}{2}$   $218\frac{3}{4}$   $219$   $219\frac{1}{4}$   $219\frac{1}{2}$   $219\frac{3}{4}$   $220$   $220\frac{1}{4}$   $220\frac{1}{2}$   $220\frac{3}{4}$   $221$   $221\frac{1}{4}$   $221\frac{1}{2}$   $221\frac{3}{4}$   $222$   $222\frac{1}{4}$   $222\frac{1}{2}$   $222\frac{3}{4}$   $223$   $223\frac{1}{4}$   $223\frac{1}{2}$   $223\frac{3}{4}$   $224$   $224\frac{1}{4}$  <