INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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(a) "Standards of Stability of Sea-going and Floating Cranes;" "Morskoy Transport" Publishing House, Leningrad, 1961, pp 74. In English.

(b) "Standards of Life-saving Appliances for Sea-going and Roadstead Ships, 1958." "Morskoy Transport" Publishing House, Leningrad, 1961, pp 45. In English.

(c) "Standards of Strength for Sea-going Steel Vessels," "Morskoy Transport" Publishing House, Leningrad, 1961, pp 42. In English.

(d) "Tarify na rahoty Voypolnyayemyye registrom SSSR," ("Charges for Work Performed by the Register of Shipping of the USSR"), "Morskoy Transport" Publishing House, Leningrad, 1960, pp 28. In Russian.

(e) The agreements between the USSR, Register of Shipping and: The Chinese Peoples Republic, in Russian, pp 4. Lloyds Ship Register, in Russian, pp 3. Bureau Veritas, in Russian, pp 4. Nippon Kaiji Kyokai, in Russian, pp 4. German Lloyd, in Russian, pp 4.

(f) "Yalta: Seaport and Resort," "Morskoy Transport" Publishing House, Moscow, 1961, in Russian and English, pp 43.

(g) "Proposals of the USSR Submitted to IMCO Sub-Committee on Subdivision and Stability Problems," "Morskoy Transport" Publishing House, 1962. In Russian and English, pp 66.

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* (h) "Regulations for Vessels Coming to the Port of Novorossisk," Abstract from the Obligatory Regulations, Novorossiysk 1959, pp 13.

(i) "Port of Leningrad/Harbor Bye-Laws," "Morskoy Transport" Publishing House, Leningrad, 1959, pp 58.

(j) "Obyazatel'noye postanorileniye upravleniya odesskogo moskogo torgovogo porta," ("Obligatory Regulations of the Administration of the Seaport of Odessa," Odessa, 1962 pp 58) UNCLASSIFIED/

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ПРЕДЛОЖЕНИЯ

СОЮЗА СОВЕТСКИХ СОЦИАЛИСТИЧЕСКИХ РЕСПУБЛИК

ПОДКОМИТЕТУ ИМКО ПО ВОПРОСАМ НЕПОТОПЛЯЕМОСТИ И ОСТОЙЧИВОСТИ МОРСКИХ СУДОВ

PROPOSALS

OF THE UNION OF SOVIET SOCIALIST REPUBLICS SUBMITTED TO IMCO SUB-COMMITTEE ON SUBDIVISION AND STABILITY PROBLEMS

1962

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ПРЕДЛОЖЕНИЯ СССР ПО ВОПРОСАМ ПОДРАЗДЕЛЕНИЯ СУДОВ НА ОТСЕКИ И ОСТОЙЧИВОСТИ СУДОВ В НЕПОВРЕЖДЕННОМ СОСТОЯНИИ

По мнению Правительства СССР выполнение рекомендаций 6, 7 и 8 Международной конференции по охране человеческой жизни на море 1960 г. должно проводиться рядом последовательных этапов.

На первом этапе этой работы Подкомитет по проблемам подразделения судов на отсеки и остойчивости должен обсудить и согласовать только общие принципы усовершенствования системы критериев, используемых для оценки подразделения корпуса судна на отсеки, общие принципы нормирования остойчивости судов в неповрежденном состоянии и составления информации об остойчивости судна для капитана, а также принципиальные вопросы распространения требований к подразделению корпуса на отсеки и на грузовые суда.

Если принципиальные вопросы, касающиеся рекомендаций 6, 7 и 8, будут согласованы, то Подкомитет легко сможет указать те дополнительные расчеты и исследования, которые будет необходимо произвести по единообразной методике в странах — участницах Подкомитета для уточнения отдельных деталей и установления конкретных численных значений нормируемых параметров. Рассмотрение результатов таких расчетов и исследований явится содержанием следующего этапа работы Подкомитета.

В связи с изложенным Правительство СССР выносит на обсуждение Подкомитета по проблемам подразделения судов на отсеки и остойчивости следующие предложения.

1. По рекомендации 6:

1.1. Принятый в Конвенции 1960 г. неявный подход к нормированию аварийной посадки с помощью фактора подразделения должен быть заменен непосредственным регламентированием минимально допускаемой величины надводного борта или запаса плавучести, остающегося после затопления определенного числа смежных отсеков. При этом величина надводного борта или запаса плавучести после аварии должна назначаться таким образом, чтобы отношение запаса плавучести поврежденного судна к объему влившейся в корпус воды закономерно возрастало с увеличением размеров судна и числа находящихся на нем пассажиров. Необходимость учета при нормировании аварийной посадки других факторов, таких, как например, энерговооруженность или остальные факторы, принимаемые ныне во внимание при определении критерия службы, не является бесспорной и нуждается в обсуждении.

1.2. Принятое в Конвенции 1960 г. нормирование аварийной остойчивости путем регламентирования получающейся после аварии

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метацентрической высоты и угла крена должно быть дополнено требованиями к диаграмме аварийной остойчивости.

2. По рекомендации 7:

2.1. Остойчивость неповрежденного судна должна быть такой, чтобы судно не опрокидывалось при совместном действии волнения и ветра, сила которого назначается в зависимости от района плавания. Помимо этого должны регламентироваться характеристики диаграммы остойчивости (угол заката, максимальное плечо, положение максимума).

2.2. Требования к остойчивости в неповрежденном состоянии должны быть в первую очередь сформулированы для добывающих промысловых судов и судов другого назначения длиной до 100 *м*.

2.3. Информация об остойчивости судна для капитана должна содержать сведения об остойчивости в типичных случаях нагрузки, а также данные, необходимые для оценки плавсоставом достаточности остойчивости в других возможных на практике условиях эксплуатации судна. Помимо этого, в информации должны быть приведены рекомендации в отношении тех мер, которые должны приниматься для обеспечения безопасности судна в условиях, когда остойчивость по тем или иным причинам может оказаться недостаточной.

2.4. Так как для полноценного нормирования остойчивости судов весьма существенным является знание фактически действующих на них внешних сил, оценить которые можно только при наличии достаточно полных сведений о морском волнении и ветре, необходимо организовать обмен соответствующей информацией, имеющейся в распоряжении отдельных стран.

К числу желательной информации относятся сведения о повторяемости ветра различной силы и направления, о высоте (или балльности) и периоде сопутствующих ему ветровых волн и зыби с указанием направления их распространения, а также статистические данные о курсе судов относительно направления ветра и волнения.

3. По рекомендации 8:

3.1. Надводный борт грузовых судов длиной 90 *м* и более после затопления одного любого отсека должен составлять по расчету не меньше одной тысячной длины судна, а характеристики аварийной остойчивости должны быть такими же, как у пассажирских судов, выдерживающих в соответствии с правилами Конвенции затопление одного любого отсека.

Невыполнение тех или иных из предъявляемых к подразделению грузовых судов на отсеки требований может допускаться Администрацией только в тех случаях, когда эти требования несовместимы с конструктивными особенностями судна, обусловливаемыми спецификой его эксплуатации.

На грузовых судах длиной менее 90 *м* указанные требования к аварийной посадке и остойчивости должны выполняться в той мере, в какой они не приведут к ухудшению эксплуатационных качеств судна.

В качестве материалов для обсуждения вносимых предложений Правительство СССР представляет подкомитету записки «О критериях непотопляемости пассажирских судов» и «Анализ возможности обеспечения непотопляемости грузовых судов длиной 90 *м* и более», текст ныне действующих в Советском Союзе норм остойчивости морских и рейдовых судов, рекомендации «Об унификации расчетов остойчивости», а также записку «Принципы составления информации об остойчивости».

О КРИТЕРИЯХ НЕПОТОПЛЯЕМОСТИ СУДОВ

Принятая в Конвенции 1960 г. по охране человеческой жизни на море система критериев непотопляемости обладает следующими недостатками:

1. Остающийся после аварии надводный борт, хотя он и является основным фактором, обеспечивающим безопасность аварийного судна, задается Конвенцией только косвенно, через численное значение коэффициента подразделения. Это лишает возможности судить о фактическом положении поврежденного судна относительно поверхности воды.

В то же время для случаев несимметричного затопления и симметричного затопления, при котором аварийная метацентрическая высота оказывается отрицательной, остающийся надводный борт задается Конвенцией непосредственно.

Такой двойственный подход сам по себе не может быть признан прочным, однако установленный Конвенцией способ расчета фактора подразделения является совершенно условным и весьма громоздким. Для определения критерия службы, а следовательно, и фактора подразделения, необходимо знать ряд величин (например, объем помещений команды, объем машинных отделений, число пассажиров ниже и выше палубы переборок), установить которые на ранних стадиях проектирования, когда должны решаться вопросы непотопляемости, практически невозможно.

Следует иметь в виду также и то, что эмпирические формулы, предложенные в свое время для определения критерия службы, ныне устарели, поскольку соотношения объемов, в зависимости от которых определяется этот критерий, изменились в связи с появлением более совершенных механических установок, имеющих уменьшенные габариты, и с изменением степени комфорта, предоставляемого пассажирам и экипажу на судах.

Кроме того, построенная обычным способом кривая предельных длин отсеков, используемая для суждения о непотопляемости судна, дает для концевых отсеков некоторую погрешность в безопасную сторону (рис. 1).

2. Введение в Конвенцию 1960 г. требования иметь после затопления отсеков положительную метацентрическую высоту не менее 5 *см* существенно повысило степень безопасности судов. Однако отклонение предложения Советского Союза о том, чтобы аварийная метацентрическая высота задавалась (будучи не менее 5 *см*) в долях от ширины судна, приводит к тому, что более крупные суда оказываются в менее благоприятном положении, нежели суда меньших размеров. Действительно, главный смысл требования получать по расчету после затопления положительную метацентрическую высоту заключается в том, чтобы иметь возможность компенсации неизбежных погрешностей, связанных с определением объема влившейся воды, положения ее центра тяжести и момента инерции площади свободной поверхности. С ростом размеров

затопленного отсека абсолютная величина таких погрешностей растет, поэтому, при одинаковом запасе в 5 *см*, большие и малые суда окажутся в разном, с точки зрения безопасности, положении.

3. Действующая Конвенция не нормирует по существу угла крена до спрямления поврежденного судна с несимметрично затопленными отсеками. Между тем, в отдельных случаях угол крена до спрямления может оказаться настолько большим, что борьба за живучесть судна (в том числе и спрямление его), а также спасение людей окажутся невозможными.[1]

4. Содержащиеся в Конвенции требования касаются, в основном, только начальной остойчивости поврежденного судна и поэтому их выполнение не может считаться гарантией безопасности потерпевшего ава-

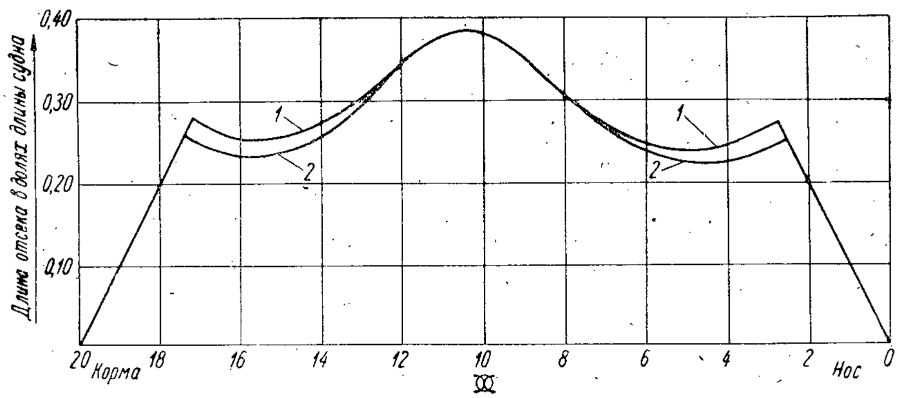

Рис. 1. Безразмерные кривые предельных длин отсеков судна при коэффициенте проницаемости $\mu = 0{,}63$;

$$\delta = 0{,}70; \quad \frac{H}{T} = 1{,}4.$$

1 — кривая построена на основании расчета аварийных посадок методом удифферентовки при $\mu = 0{,}63$; *2* — кривая получена умножением значений предельных длин отсеков, найденных в результате расчета аварийных посадок методом удифферентовки при $\mu = 1{,}0$, на отношение 1,0 : 0,63.

рию судна. Диаграмма остойчивости судна, получившего пробоину, может оказаться совершенно неприемлемой, несмотря на значительную начальную метацентрическую высоту и допустимый угол крена (рис. 2).

Указанные недостатки Конвенции в части нормирования непотопляемости могут быть устранены, если считать непотопляемым судно, у которого:

— остающийся при затоплении определенного числа (одного, двух или трех в зависимости от размеров и назначения судна) отсеков надводный борт или запас плавучести не меньше некоторой определенной величины;

— аварийная метацентрическая высота положительна и не меньше некоторой зависящей от размеров судна величины;

— угол крена при несимметричном затоплении не превосходит до принятия мер выравнивания и после их осуществления некоторых предельных, устанавливаемых заранее, величин;

— диаграмма остойчивости поврежденного судна обеспечивает минимально допустимую степень безопасности судна при действии на него внешних кренящих моментов.

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[1] Примером, подтверждающим справедливость сказанного, является большой пассажирский пароход, у которого расчетный угол крена при несимметричном затоплении котельных отделений доходит до 28°.

Для практического использования этих критериев необходимо установить:

— наименьший, допустимый с точки зрения безопасности, надводный борт или запас плавучести, остающийся после аварии;

— наименьшую, допустимую с учетом погрешностей ее определения, метацентрическую высоту при симметричном затоплении отсека или отсеков судна;

— наибольший допустимый угол крена при несимметричном затоплении отсеков до и после спрямления;

— характеристики диаграммы остойчивости аварийного судна, позволяющие считать ее достаточной с точки зрения обеспечения безопасности судна;

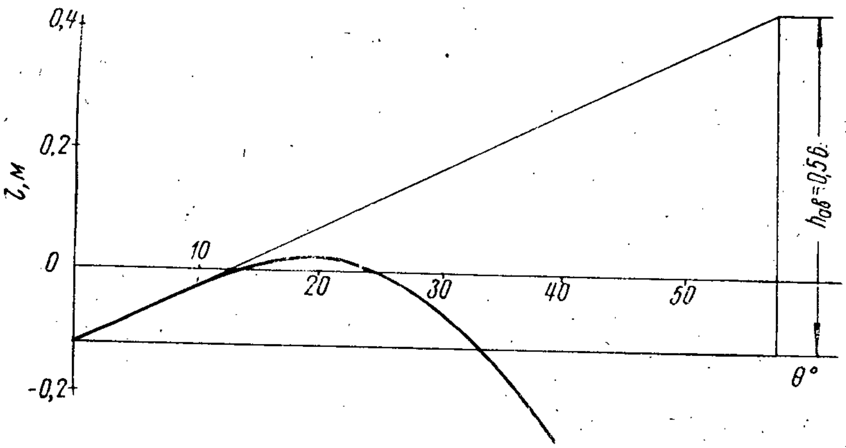

Рис. 2. Неудовлетворительная диаграмма аварийной остойчивости при значительной начальной метацентрической высоте ($h_{ав} = 0{,}56$ *м*) и допустимом угле статического крена ($\theta_{ст} = 14°$).

Элементы судна: длина $L_{\perp\perp}=76{,}8$ *м*, ширина $B=12{,}6$ *м*; высота борта $H=5{,}6$ *м*, осадка $T=3{,}6$ *м*.

— размеры судов различного назначения, начиная с которых технически возможно и практически рационально требовать получения установленных характеристик аварийной посадки и аварийной остойчивости.

Кроме того, должны быть пересмотрены размеры (длина, высота и глубина) расчетной пробоины, от которых во многих случаях зависит степень несимметричности затопления, а также степень уменьшения остойчивости при повреждении.

I. О высоте остающегося после аварии надводного борта

Полученная в результате расчета непотопляемости величина остающегося после аварии надводного борта определяет собой:

— запас аварийной плавучести, являющийся основным фактором, обеспечивающим нахождение поврежденного судна на поверхности воды;

— заливаемость поврежденного судна на взволнованном море;

— запас аварийной остойчивости, поскольку, при прочих равных условиях, от высоты борта зависят площадь и форма диаграммы остойчивости поврежденного судна.

Не располагая значительным фактическим материалом по авариям судов и по поведению аварийного судна на волнении, нельзя внести предложений о радикальном изменении высоты остающегося после затопления отсеков надводного борта по сравнению с той, которая получается у судна аналогичных размеров и назначения в результате расчетов по Конвенции 1960 г.

Тем не менее, при переходе к явному нормированию остающегося после аварии надводного борта следует исправить очевидные несообразности, получающиеся при расчете высоты надводного борта по Конвенции 1960 г.

В частности, представляется неправильным задавать наименьший допустимый аварийный надводный борт, получающийся ныне при факторе подразделения, равном единице, половине и одной трети, одинаковым для судов всех размеров и равным 76 *мм*.

По нашему мнению, остающийся после аварии надводный борт должен быть по крайней мере таким, чтобы получающийся запас плавучести был бы достаточным для компенсации возможной погрешности расчета объема влившейся в поврежденный отсек воды, связанной с приближенным определением коэффициентов проницаемости.

При существующей практике назначения, независимо от размеров судна, минимальной высоты остающегося после аварии надводного борта, равной 76 *мм*, это условие не выполняется. Даже, если рассматривать только геометрически подобные суда с подобными размерами затопленных отсеков, то и в этом случае сохранение одинакового надводного борта приводит при увеличении размеров судна к уменьшению отношения запаса аварийной плавучести к объему влившейся в корпус воды, и следовательно, к уменьшению вероятности компенсации погрешностей расчета непотопляемости крупных судов. Если же учесть, что с ростом длины судов отношение высоты борта к осадке растет, что ведет к увеличению предельной длины затопления и к дальнейшему увеличению количества влившейся воды, а также к уменьшению аварийного запаса плавучести, то необоснованность сохранения требования иметь остающийся надводный борт равным 76 *мм* на судах любых размеров станет очевидной.

Для того, чтобы поставить геометрически подобные суда разного размера в одинаковые условия в части компенсации возможной погрешности расчета количества попавшей в корпус судна воды, необходимо требовать обеспечения у аварийного судна надводного борта, величина которого будет прямо пропорциональна какому-либо из размерений, в частности, длине судна. У судов, не являющихся геометрически подобными, указанное требование будет выполняться в том случае, если коэффициент пропорциональности в формуле, связывающей остающийся после аварии надводный борт с длиной судна, будет меняться в зависимости от отношения высоты борта к осадке, длины судна к осадке и от коэффициентов полноты. Однако, учитывая желательность упрощения требований и относительно слабое влияние перечисленных характеристик на получаемый результат, представляется возможным задавать остающийся надводный борт в зависимости только от одной лишь длины судна.

В связи со сказанным представляется разумным ввести в Конвенцию требование иметь минимальный надводный борт аварийного судна равным не 76 *мм*, как это указано в действующей Конвенции, а одной тысячной длины судна.

При переходе к судам, у которых в настоящее время фактор подразделения не равен единице, половине или одной трети, действующая Конвенция автоматически требует обеспечения различного надводного борта при затоплении отсеков в средней части и в оконечностях судна (рис. 3). Происходит это потому, что при установлении допустимой длины отсека как определенной части предельной длины затопления, остающийся надводный борт при заполнении водой отсеков, расположенных не в средней части судна, увеличивается в большей степени из-за уменьшения не только средней осадки, но и дифферентующего момента.

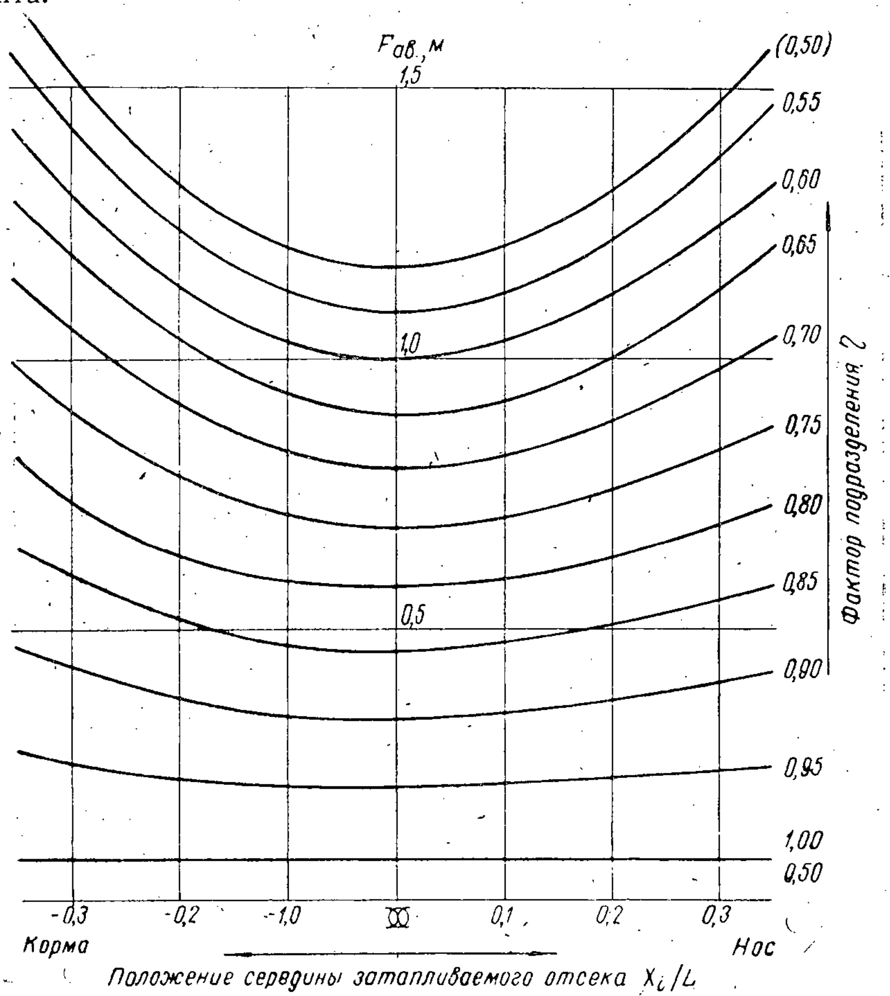

Рис. 3. Зависимость величины требуемого надводного борта $F_{ав}$ от расположения затапливаемого отсека по длине судна и от фактора подразделения η.

Элементы судна: длина $L_{\perp\perp}$ = 100 м, высота борта H = 6,65 м, осадка T = 4,75 м.

Запас аварийной плавучести при этом оказывается заметно большим при затоплении отсеков со срединой на расстоянии примерно четверти или трети длины от мидель-шпангоута (рис. 4).

Сохранять (при переходе к непосредственному назначению высоты остающегося при аварии надводного борта) требование иметь различный надводный борт при затоплении отсеков в разных районах по длине судна, как это подразумевается действующей Конвенцией, представляется не обязательным.

Основанием для такого вывода является то, что в ряде случаев (при факторе подразделения, равном единице, половине и одной трети) действующая Конвенция считает достаточным иметь одинаковый надводный борт при затоплении отсеков, находящихся в любом месте по длине судна. Кроме того, статистические данные (рис. 5) показывают, что на крупных судах (а именно на них в настоящее время фактор подразделения получается меньше единицы, но больше половины) фактическая длина отсеков оказывается меньше предельно допускаемой для средней части судна. В результате фактическая высота надводного

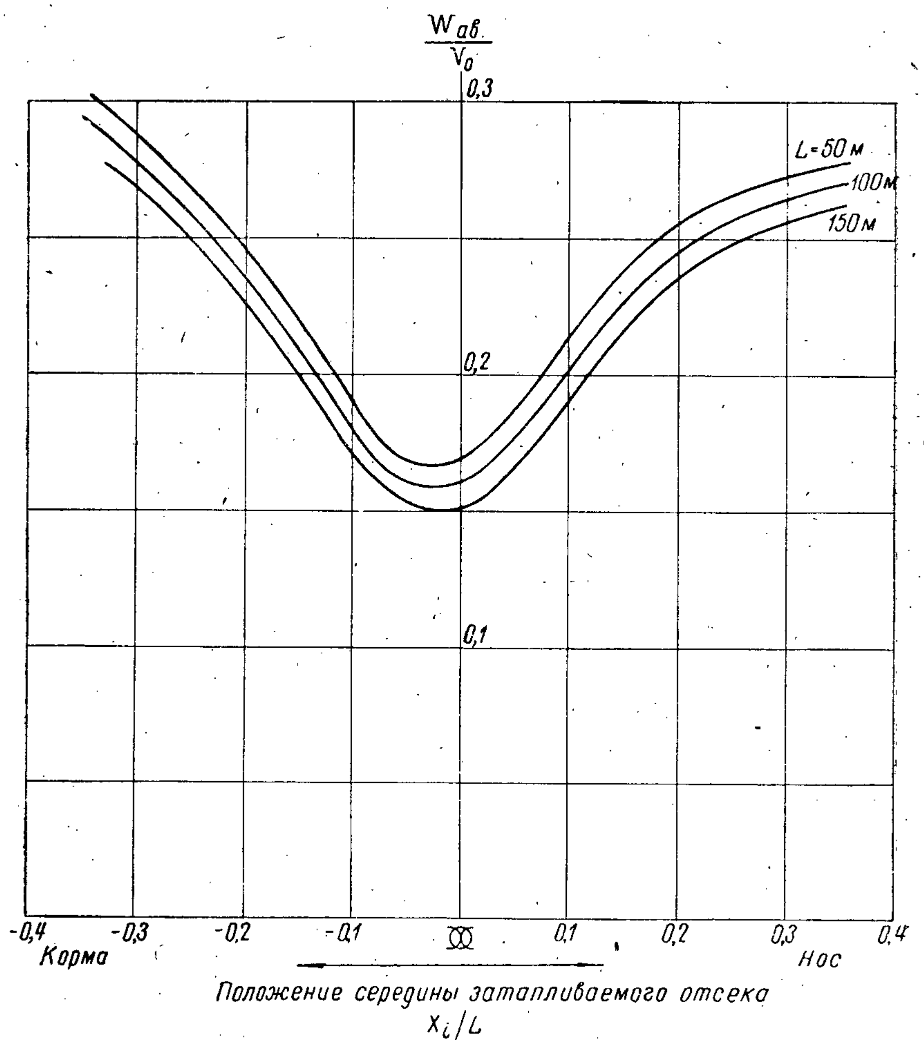

Рис. 4. Зависимость относительного запаса плавучести судна после аварии от расположения затопленного отсека по длине судна.

Характеристики судов: $L : H = 15$; $H : T = 1{,}4$. Фактор подразделения $\eta = 0{,}80$. $W_{ав}$ — остающийся после аварии запас плавучести; V_0 — объемное водоизмещение неповрежденного судна.

борта при затоплении средних отсеков оказывается больше, чем допускается действующей Конвенцией и становится близкой к высоте борта, остающейся при затоплении отсеков в оконечностях.

Из сказанного о фактически получающейся высоте надводного борта аварийного судна следует, что при назначении высоты остающегося надводного борта целесообразно исходить не из получающейся по расчету в соответствии с действующей Конвенцией высоты надводного борта при затоплении средних отсеков, а из высоты борта, остающегося при повреждении отсеков со срединой на расстоянии примерно четверти длины судна от мидель-шпангоута.

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В отличие от действующей Конвенции, при переходе к непосредственному нормированию высоты надводного борта поврежденного судна представляется правильным не принимать во внимание ряд факторов, учет которых, будучи достаточно сложным, не может быть логически обоснован или приводит (по Конвенции 1960 г.) к незначительному изменению требуемой высоты надводного борта.

Для выявления влияния отдельных факторов, определяющих по Конвенции 1960 г. высоту остающегося после аварии надводного борта, был произведен расчет высоты надводного борта судов разной длины с закономерно изменяющимися объемами машинных отделений, числом пассажиров и команды, объемом помещений, приходящимся на одного

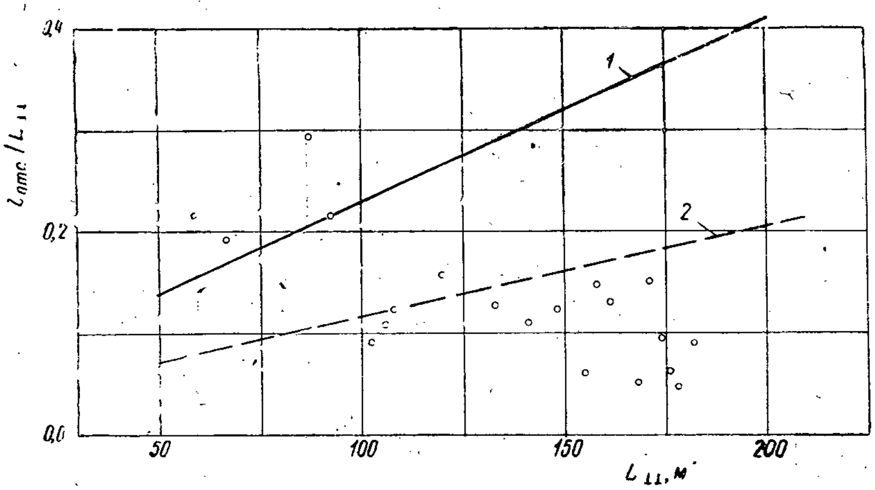

Рис. 5. Фактические и допустимые длины средних отсеков пассажирских судов, построенных в 1957—1958 гг.

1 — относительная предельная длина отсека (фактор подразделения $\eta = 1,0$); *2* — относительная допустимая длина отсека при факторе подразделения $\eta = 0,5$. Предельные и допустимые длины определены для судов с отношением длины к высоте борта до палубы переборок 13,5 и с минимальной высотой надводного борта.

человека, и с различным количеством пассажиров выше и ниже палубы переборок.

Расчеты производились применительно к судам с коэффициентом общей полноты $\delta = 0,60$ и с отношением длины к высоте борта до палубы переборок, равным 13,5. Коэффициент проницаемости объемов условно принимался равным единице.

Учет соотношения между объемами машинных отделений и корпуса ниже предельной линии погружения представляется нецелесообразным, хотя влияние этого отношения на остающийся надводный борт по Конвенции 1960 г. оказывается весьма значительным (рис. 6).

При составлении формул для определения критерия службы, по-видимому, считалось, что относительный объем машинных отделений возрастает с ростом скорости судна, от которой как-то зависят вероятность столкновения и размеры повреждения. Могло быть принято во внимание и увеличение стоимости судна при увеличении мощности механизмов, что делает более ощутимым последствия гибели такого судна. Вероятно, в связи с этим, при увеличении отношения объема машинных отделений к объему корпуса ниже предельной линии погружения Конвенция 1929 г., а затем Конвенции 1948 и 1960 гг. требовали увеличения высоты остающегося после аварии надводного борта.

Однако вероятность столкновения и размеры повреждения зависят не только от скорости судна, непотопляемость которого проверяется, но и (в большей степени) от скорости и размеров того судна, которое с ним столкнется.[1] Кроме того, следует иметь в виду, что в настоящее время прямую зависимость между скоростью и объемом машинных отделений установить трудно, так как некоторые типы установок при большой мощности имеют относительно небольшие габариты.

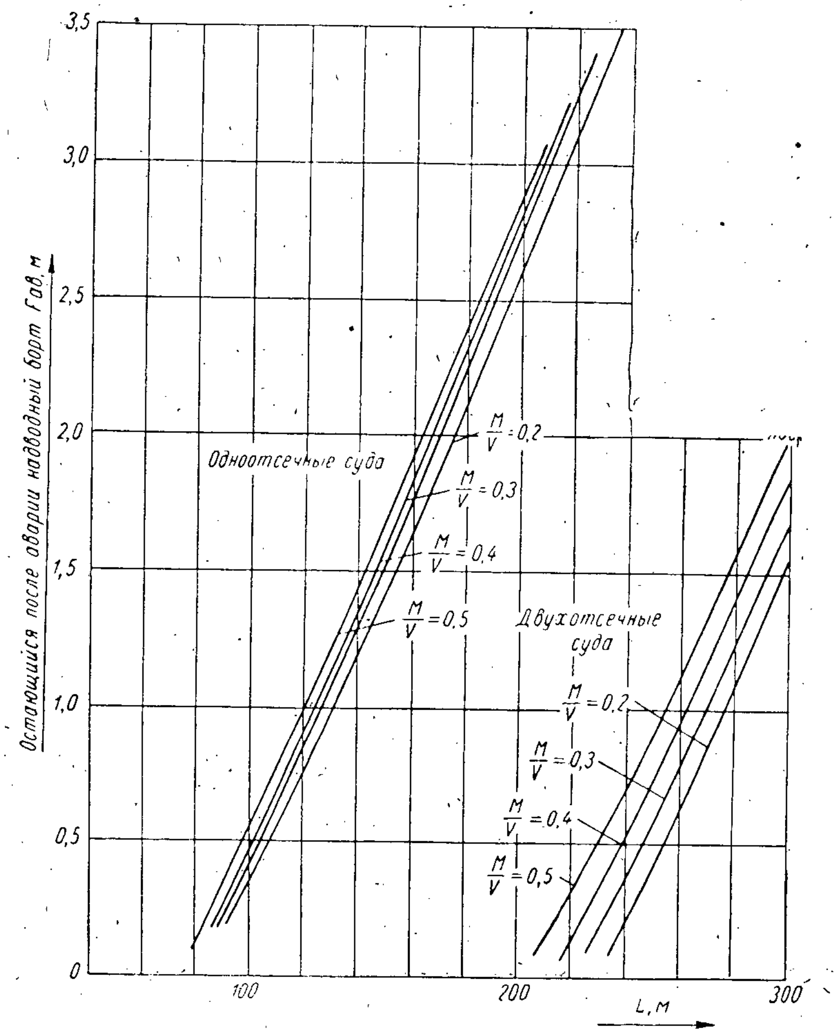

Рис. 6. Влияние отношения объема машинного отделения к объему корпуса ниже предельной линии погружения на оставшийся после аварии надводный борт.

Общее число пассажиров — 1000 чел., из них под палубой переборок — 100 чел.; объем помещений, приходящихся на одного пассажира — 20 $м^3$;
M — объем машинного отделения;
V — объем корпуса судна ниже предельной линии погружения.

Помимо указанных обстоятельств нужно учесть также и то, что более быстроходные современные суда, как правило, имеют лучшие радиотехнические средства наблюдения и более квалифицированный экипаж, что уменьшает вероятность столкновения.

Основываясь на сказанном, следует обсудить возможность не учитывать характеристики механизмов при назначении высоты остающегося при аварии надводного борта, имея в виду, что это положение является

[1] Как известно, при столкновениях большие повреждения получают суда, которым наносит удар встречное судно.

спорным. Существенное, в некоторых случаях, влияние на требуемую Конвенцией 1960 г. величину надводного борта поврежденного судна оказывает соотношение между количеством пассажиров, размещенных выше и ниже палубы переборок (рис. 7). Подыскать какое-либо логиче-

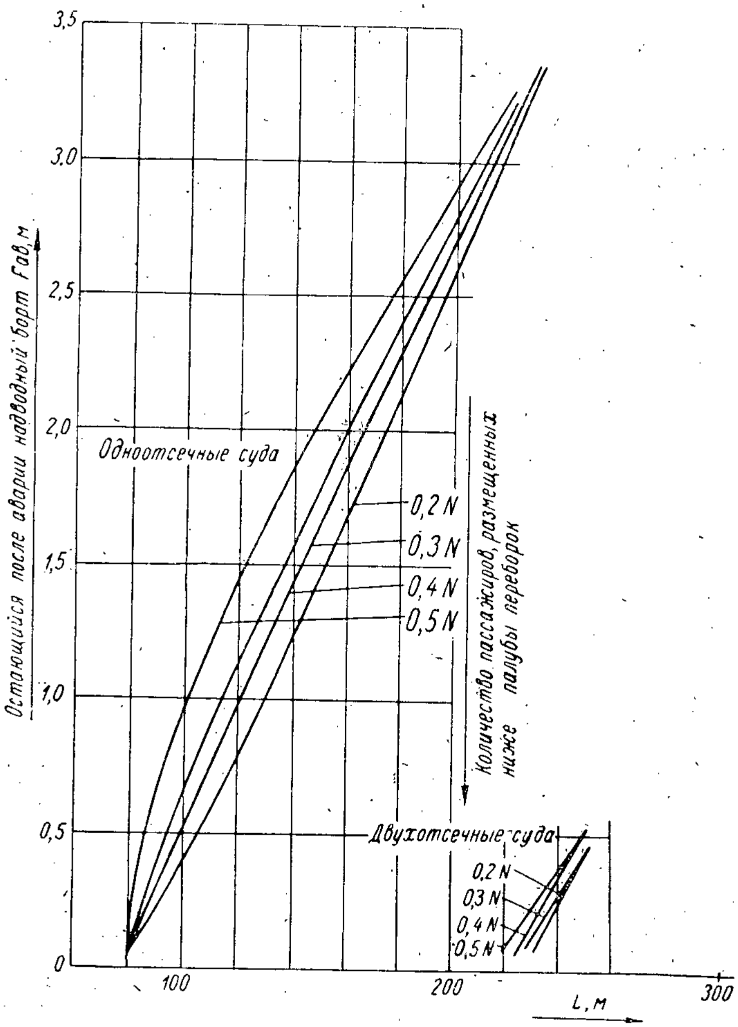

Рис. 7. Влияние количества пассажиров, размещенных ниже палубы переборок, на остающийся после аварии надводный борт.

Число пассажиров $N=1000$ чел.; объем, приходящийся на одного пассажира, — 20 $м^3$; число членов экипажа — 500 чел. Объем машинного отделения составляет 0,4 от объема корпуса ниже предельной линии погружения. На одного члена экипажа приходится 7 $м^3$.

$\frac{H}{T}=1,4$; $\frac{L}{H}=13,5$; $\delta=0,60$.

ское объяснение приданию большего аварийного надводного борта судну, на котором относительно большая часть пассажиров размещается под палубой переборок, не удалось.[1] Поэтому представляется возможным, в отличие от действующей Конвенции, не учитывать указанный фактор при назначении высоты надводного борта аварийного судна.

[1] Время выхода пассажиров на открытые палубы и к спасательным шлюпкам зависит не столько от того, ниже или выше палубы переборок они размещаются, сколько от продуманного расположения трапов, коридоров и дверей на судне.

Остальные факторы, от которых зависит по Конвенции 1948 г. фактор подразделения, а следовательно, и остающийся после аварии надводный борт,— объем, приходящийся на одного пассажира и соотношение между числом пассажиров и экипажем, по нашему мнению, могут не учитываться, поскольку их влияние относительно невелико (рис. 8).

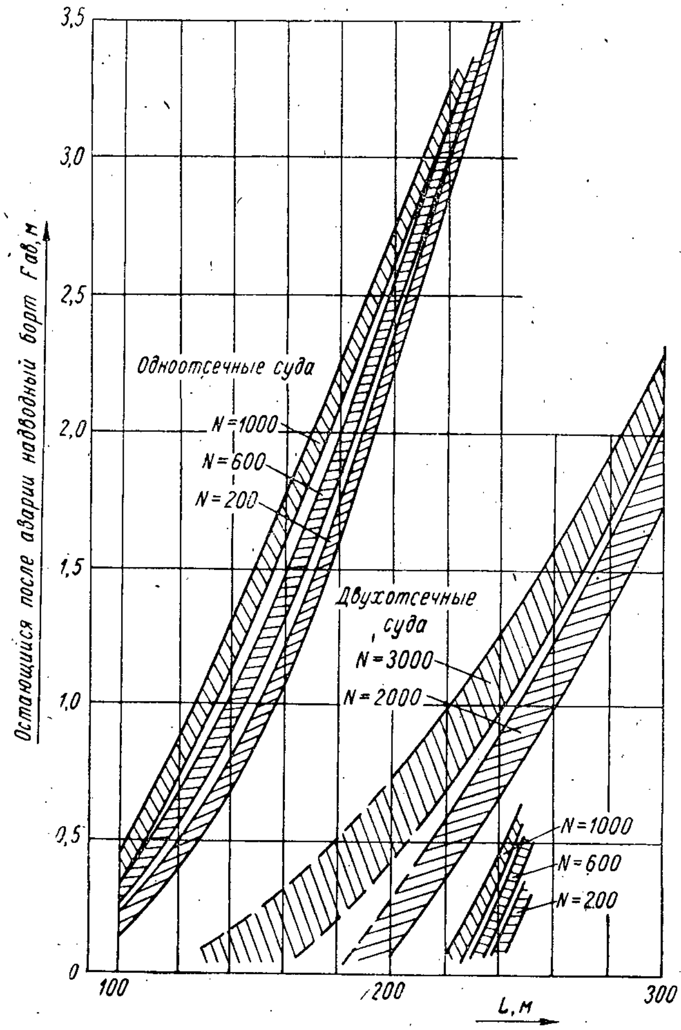

Рис. 8. Влияние числа пассажиров и других факторов на остающийся после аварии надводный борт.

Внутри заштрихованных зон: отношение объема машинного отделения M к объему корпуса судна ниже предельной линии погружения V меняется от $\frac{M}{V}=0{,}2$ до $\frac{M}{V}=0{,}3$; объем помещений, приходящийся на одного пассажира, меняется от 20 до 30 $м^3$; количество членов экипажа меняется от 0,25 N до 0,5 N; объем помещений на одного члена экипажа — 7 $м^3$. $\frac{H}{T}=1{,}4$; $\frac{L}{H}=13{,}5$; $\delta=0{,}60$.

Основываясь на сказанном, предлагается рассмотреть возможность сохранения при переходе к явному нормированию надводного борта из числа факторов, учитываемых ныне Конвенцией 1960 г., лишь длину судна и число находящихся на борту людей.

Однако помимо этих факторов при назначении высоты надводного борта пассажирского судна необходимо учитывать также и геометрические характеристики формы корпуса, которые ныне автоматически учитываются при определении предельной длины затопления. При этом представляется рациональным требовать получения у судов равной длины, перевозящих одинаковое количество пассажиров, одного и того же относительного запаса плавучести.

Как показывают соответствующие расчеты, для сохранения неизменного отношения запаса плавучести к водоизмещению судна остающийся надводный борт должен (при неизменной длине судна) изменяться обратно пропорционально отношению длины судна к высоте борта. Примером формул, по которым можно было бы определять требуемую высоту аварийного надводного борта, являются зависимости (1) и (2).

Остающийся после аварии надводный борт пассажирских судов, которые должны выдерживать затопление одного любого отсека, можно связать с длиной судна и числом пассажиров зависимостью:

$$F_{ав}=13{,}5(L-40)\left(\frac{7N}{1000}+1\right)\frac{H}{L}+40. \qquad (1)$$

У пассажирских судов, которые должны оставаться на плаву при затоплении любых двух смежных отсеков, наименьший надводный борт должен быть не меньше определяемого формулой (2):

$$F_{ав}=13{,}5(L-120)\left(\frac{2{,}3N}{1000}+1\right)\frac{H}{L}+120. \qquad (2)$$

В формулах (1) и (2):
$F_{ав}$ — остающийся после аварии надводный борт, *мм*,
L — длина судна между перпендикулярами, *м*,
H — высота борта до палубы переборок на миделе, *м*,
N — число пассажиров.

Основания для выбора структуры формул (1) и (2), а также для определения численных значений входящих в них численных коэффициентов были следующими.

Минимальным допустимым по соображениям компенсации возможной погрешности расчета количества влившейся в корпус воды был признан, как уже отмечалось, остающийся после аварии надводный борт, равный одной тысячной длины судна. Такой остающийся надводный борт должен обеспечиваться на непассажирских — грузовых и промысловых судах тех размеров, на которые будет признано возможным распространить требования к непотопляемости, зафиксированные в Конвенции.

На пассажирских судах с минимальным числом пассажиров остающийся после аварии надводный борт также должен приниматься равным одной тысячной длины судна, однако с увеличением числа пассажиров рационально увеличивать высоту надводного борта и, следовательно, запас аварийной плавучести, определяющий собой, как уже указывалось, степень безопасности поврежденного судна.

При этом степень увеличения запаса аварийной плавучести с ростом числа пассажиров может быть принята меньшей у судов, выдерживающих затопление двух смежных отсеков, поскольку эти суда, в отличие от судов, способных оставаться на плаву при затоплении только одного любого отсека, могут не погибнуть при пробоине в районе главной поперечной водонепроницаемой переборки, что само по себе существенно увеличивает степень их безопасности.

У пассажирских судов, которые должны, в соответствии с Конвенцией, быть непотопляемыми при заполнении водой любых трех смежных отсеков, рационально вообще не требовать какого-либо дополнительного увеличения высоты остающегося надводного борта по сравнению с минимально допустимым, так как выполнение требования выдерживать затопление трех отсеков обеспечивает достаточную степень безопасности.

В результате анализа непотопляемости спроектированных и построенных пассажирских судов, было установлено, что непотопляемость при затоплении одного любого отсека технически возможно обеспечить:

— при затоплении одного любого отсека, начиная с длины 40 *м*;

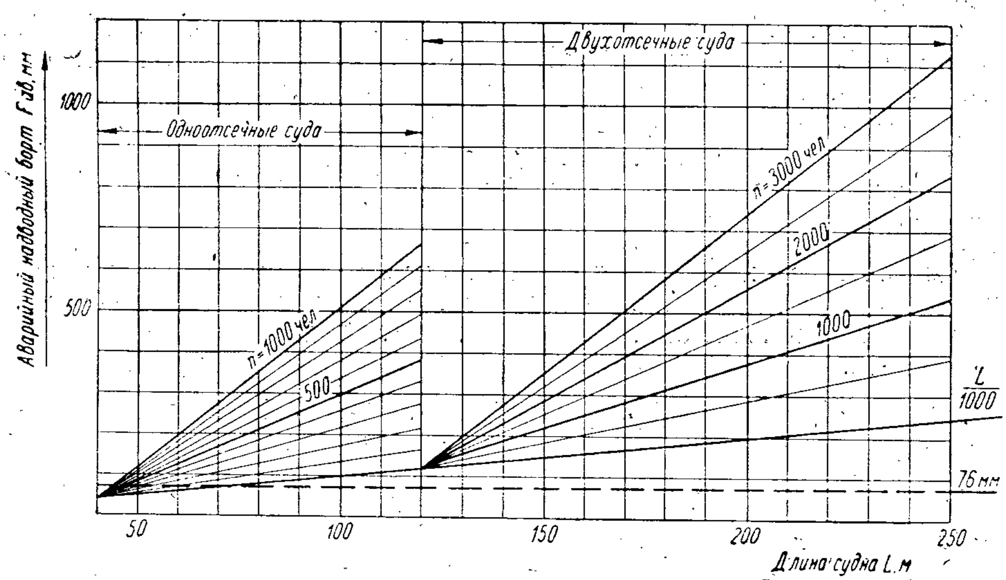

Рис. 9. Предлагаемая зависимость остающегося после аварии надводного борта от длины судна и числа пассажиров

$$\left(\frac{L}{H} = 13{,}5\right)$$

— при затоплении любых двух смежных отсеков, начиная с длины 120 *м*;

— при затоплении любых трех смежных отсеков, начиная с длины 250 *м*.

Определив затем высоту остающегося надводного борта, получающегося по действующей Конвенции у судна длиной 120 *м*, перевозящего 500 пассажиров, и у судна длиной 250 *м*, имеющего на борту 2000 пассажиров, можно было, в соответствии с рис. 9, получить формулы (1) и (2), предположив, что остающийся надводный борт должен увеличиваться прямо пропорционально числу пассажиров.

Оценивая целесообразность перехода к предлагаемому явному нормированию остающегося после аварии надводного борта, следует иметь в виду, что при нем сохраняется возможность построения кривой допустимых длин отсеков, представляющей известные удобства для проектировщиков при решении ими вопроса о расположении поперечных водонепроницаемых переборок на судне.

Конвенция 1960 г. предъявляет, как известно, более жесткие требования к высоте надводного борта судов так называемых коротких линий, перевозящих большое количество пассажиров, не обеспеченных полностью местами в спасательных шлюпках. Не рассматривая подробно этот вопрос, нужно указать на то, что увеличение высоты остающегося при аварии надводного борта судна, непотопляемость которого обеспечивается при затоплении только одного отсека, не может считаться основанием для отказа от снабжения всех пассажиров спасательными средствами, так как никакое увеличение высоты остающегося надводного борта не поможет такому судну остаться на плаву при пробоине в районе поперечной переборки. Для упомянутых судов уменьшение числа спасательных шлюпок может допускаться только в том случае, если эти суда могут выдерживать затопление любых двух смежных отсеков. При этом специально увеличивать остающийся надводный борт поврежденного судна не обязательно.

Не исключено, что для подобных судов следует требовать обеспечения непотопляемости при затоплении любых двух отсеков, начиная с меньших размеров, нежели у судов неограниченного плавания. Однако отсутствие в нашей стране опыта постройки и эксплуатации судов коротких линий не позволяет внести в этой части какого-либо конкретного предложения.

II. О нормировании аварийной остойчивости судов

Для того, чтобы исключить возможность опрокидывания судна при попытках выравнять крен, являющийся следствием отрицательной начальной остойчивости, аварийная метацентрическая высота до принятия мер по спрямлению судна должна быть, как это и записано в Конвенции 1960 г., положительной. Учитывая возможные погрешности расчета, следует требовать получения аварийной метацентрической высоты $h_{ав}$ в любом случае нагрузки и затопления, равной пяти тысячным от ширины судна B

$$h_{ав}=0,005B.$$

При этом следует оговорить, как это и сделано в действующей Конвенции, что ни в каких случаях аварийная метацентрическая высота не должна быть меньше 0,05 *м*, так как обеспечить большую точность определения $h_{ав}$ вряд ли возможно.

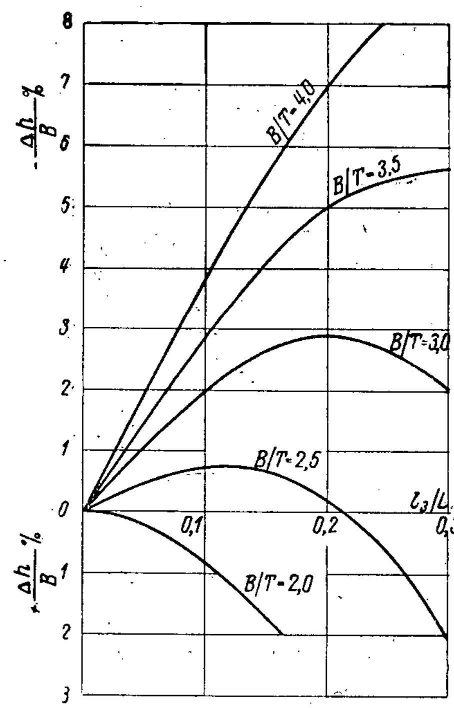

Рис. 10. Потеря начальной метацентрической высоты при симметричном затоплении отсеков разной длины у судов с различным отношением ширины B к осадке T при незатопленном двойном дне, высота которого равна 0,155 T.

Коэффициент общей полноты судна $\delta=0,60$, коэффициент проницаемости 1,0.

Такие численные значения аварийной метацентрической высоты должны получаться при расчете непотопляемости методом постоянного водоизмещения.

Выполнение указанного требования может представить известные трудности на судах с отношением ширины B к осадке T больше $2,8\div2,9$ (рис. 10). На судах с меньшим отношением B/T это требование выполняется автоматически даже при затоплении отсека предельной длины в случае, если метацентрическая высота неповрежденного судна в са-

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мом плохом с точки зрения остойчивости состоянии нагрузки будет равна примерно 0,02 B[1].

На судах с большими отношениями ширины к осадке выполнение предлагаемого требования к аварийной метацентрической высоте облегчается тем, что такие суда в большинстве случаев оказываются пассажирскими судами, у которых требование иметь больший аварийный надводный борт приводит к уменьшению относительной длины затопления.

Однако требование иметь $h_{ав}=0{,}005\ B$ и не меньше 0,05 *м*, будучи безусловно необходимым, не является, как было показано ранее (рис. 2), достаточным.

Как уже отмечалось, для обеспечения возможности ведения борьбы за живучесть поврежденного судна и спасения находящихся на нем людей необходимо ограничить угол крена в конечной стадии несимметричного затопления до выравнивания. По нашему мнению, расчетный угол крена в конечной стадии несимметричного затопления при наихудшем возможном в процессе эксплуатации состоянии нагрузки не должен превосходить 15°. При назначении этого угла учитывалось, что уже угол крена, равный 12°, оказывается так называемым углом паники, превышение которого оказывает тяжелое психологическое воздействие на неподготовленных людей. Оценивая целесообразность назначения угла крена равным 15°, следует иметь в виду, что в промежуточных стадиях затопления угол крена может быть больше на 5—6° (рис. 11); кроме того, этот угол может увеличиться примерно на 2—3° из-за вероятной и допускаемой в практике эксплуатации несимметричности загрузки. Таким образом, оговаривая расчетный угол крена в конечной стадии несимметричного затопления, равным 15°, мы фактически допускаем появление в процессе аварии значительно больших углов крена.

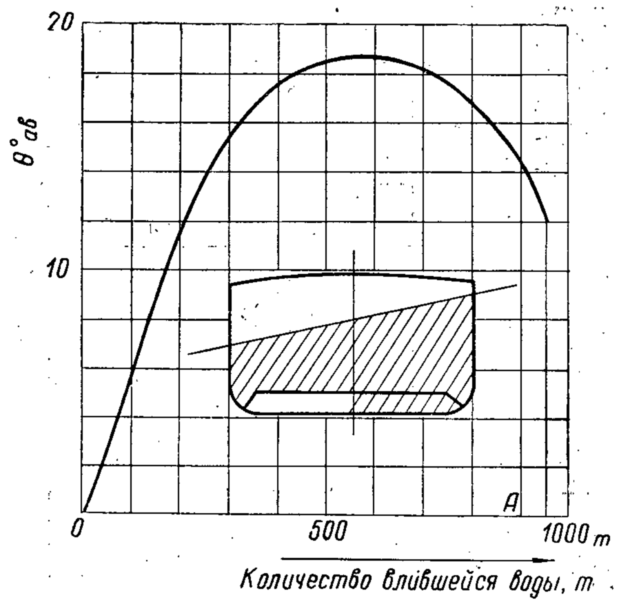

Рис. 11. Изменение угла крена $\theta°_{ав}$ в процессе несимметричного затопления отсека.

Элементы судна: длина $L_{\perp\perp}$ — 90,0 *м*, ширина B = 14,0 *м*; высота борта H = 7,2 *м*.

Указанные требования к начальной аварийной метацентрической высоте поврежденного судна и к углу крена в конечной стадии затопления могут быть выполнены при совершенно неприемлемых диаграммах остойчивости аварийного судна (см. рис. 2).

Поэтому представляется необходимым регламентировать характеристики диаграммы остойчивости поврежденного судна в наихудших возможных в процессе эксплуатации случаях затопления и нагрузки судна.

[1] Как известно, при неизменной длине затопления поправка к метацентрической высоте неповрежденного судна резко возрастает с увеличением B/T; при B/T ⩽ 2,2 аварийная метацентрическая высота может даже увеличиться по сравнению с неповрежденным судном.

Рассмотрение диаграммы остойчивости судна с затопленным отсеком предельной длины (рис. 12) показало, что наихудшим является случай аварии в конце рейса, когда метацентрическая высота неповрежденного судна наименьшая. Двойное дно при этом считалось неповрежденным.

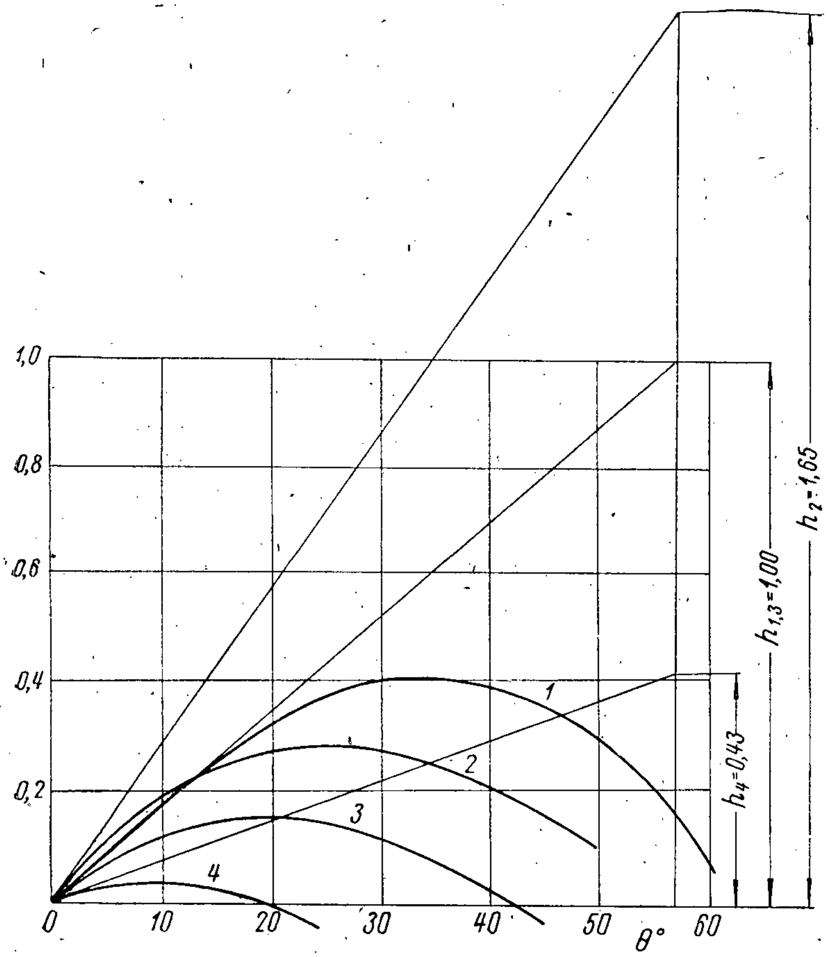

Рис. 12. Диаграммы остойчивости сухогрузного судна в разных состояниях нагрузки при затоплении отсека предельной длины.

Элементы судна: длина $L_{\perp\perp}$=120,0 *м*, отношение ширины к осадке $\frac{B}{T}$=2,5 *м*, отношение высоты борта к осадке $\frac{H}{T}$=1,27; коэффициент общей полноты δ=0,70, суммарная длина надстроек $l_н$=0,4 $L_{\perp\perp}$.

1 — неповрежденное судно в начале рейса; *2* — затоплен отсек, включая двойное дно, судно в начале рейса; *3* — затоплен отсек выше неповрежденного двойного дна, судно в начале рейса; *4* — затоплен отсек выше неповрежденного двойного дна, судно в конце рейса.

По-видимому, именно для этого случая следует в первую очередь проверять характеристики диаграммы остойчивости.

Сформулировать достаточно обоснованные и практически выполнимые требования к диаграммам статической остойчивости поврежденных судов в настоящее время не представляется возможным из-за отсутствия необходимого статистического материала. Учитывая важность его накопления, а также то, что именно диаграммы остойчивости определяют собой фактическую степень безопасности поврежденного судна при действии кренящих моментов, предлагается включить в текст

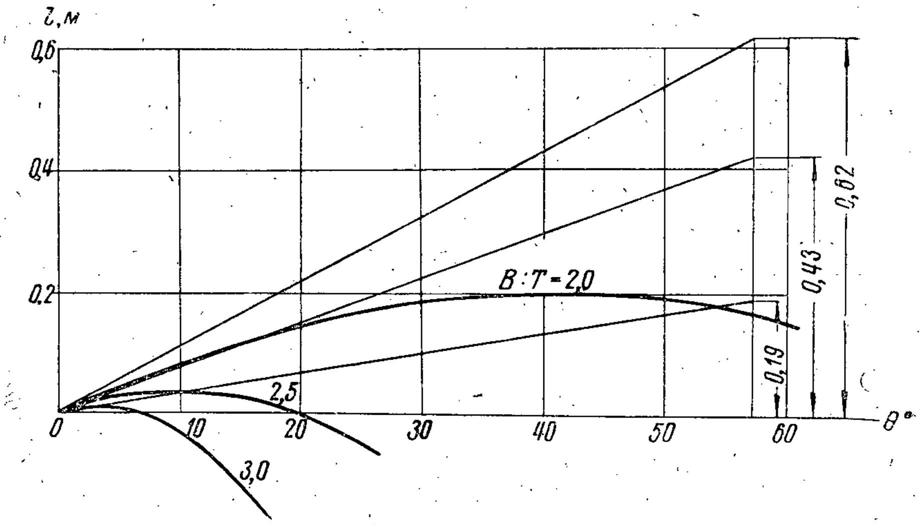

Рис. 13. Влияние отношения ширины к осадке на диаграмму остойчивости судна с затопленным отсеком предельной длины.

Элементы судна: длина $L_{\perp\perp}$ = 120 *м*, отношение высоты борта к осадке $\frac{H}{T}$ = 1,27, коэффициент общей полноты δ = 0,70, суммарная длина надстроек $l_{н}=0{,}40\,L_{\perp\perp}$.

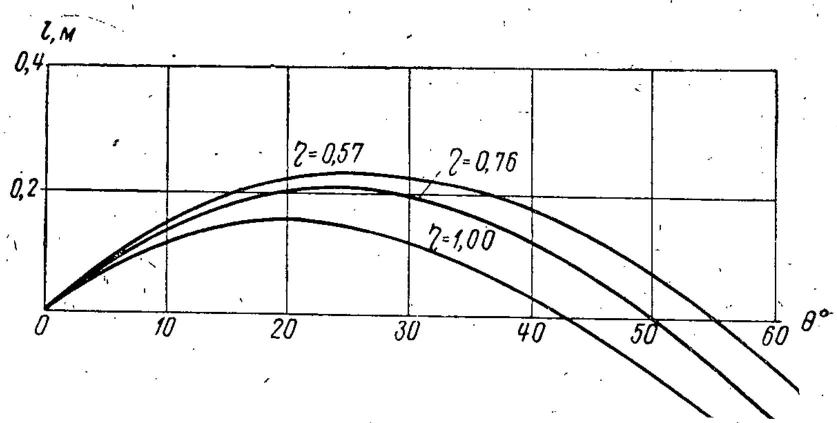

Рис. 14. Диаграммы остойчивости судна с затопленным отсеком при различных факторах подразделения η (двойное дно не затоплено).

Элементы судна: длина $L_{\perp\perp}$=120 *м*, отношение ширины судна к осадке $\frac{B}{T}$=2,5; отношение высоты борта к осадке $\frac{H}{T}$=1,27, коэффициент общей полноты δ=0,70, суммарная длина надстроек $l_{н}$ =0,4 *L*.

Фактор подразделения η	Длина затопленного отсека $l_{отс}$	Остающийся после аварии надводный борт $F_{ав}$, м	Максимальное плечо остойчивости l_{max}, м	Угол заката $\theta^{\circ}_{зак}$
1,0	0,263$L_{\perp\perp}$	0,51	0,15	42
0,76	0,200$L_{\perp\perp}$	0,97	0,21	50
0,57	0,150$L_{\perp\perp}$	1,31	0,23	55

Конвенции указание об обязательном представлении на рассмотрение Администрации диаграмм остойчивости вновь строящихся судов для наихудших возможных случаев затопления и нагрузки.

Имеющийся опыт позволяет рекомендовать стремиться к получению максимального плеча статической остойчивости поврежденного судна не меньше 0,1 *м* при угле заката или обрыва диаграммы из-за распространения воды по судну не менее 30° в случае симметричного и 35° в случае несимметричного затопления отсеков.

Возможность выполнения этих, весьма жестких для судов с большими отношениями ширины к осадке (рис. 13), требований подтверждается сведениями о характеристиках диаграмм остойчивости поврежденных судов.

Следует отметить, что Конвенция 1960 г., не предъявляя каких-либо специальных требований к остойчивости, автоматически обеспечивает большую степень безопасности для судов с меньшим фактором подразделения за счет уменьшения длины затопленного отсека и увеличения, вследствие этого, высоты остающегося при аварии надводного борта (рис. 14).

Аналогичное положение сохранится и при предлагаемом явном нормировании величины остающегося после аварии надводного борта в зависимости от длины, числа пассажиров и отношения высоты борта неповрежденного судна до палубы переборок к его длине.

III. О расчетных размерах пробоин

Регламентирование продольного размера повреждения исключает, при принятом подходе к нормированию непотопляемости, возможность

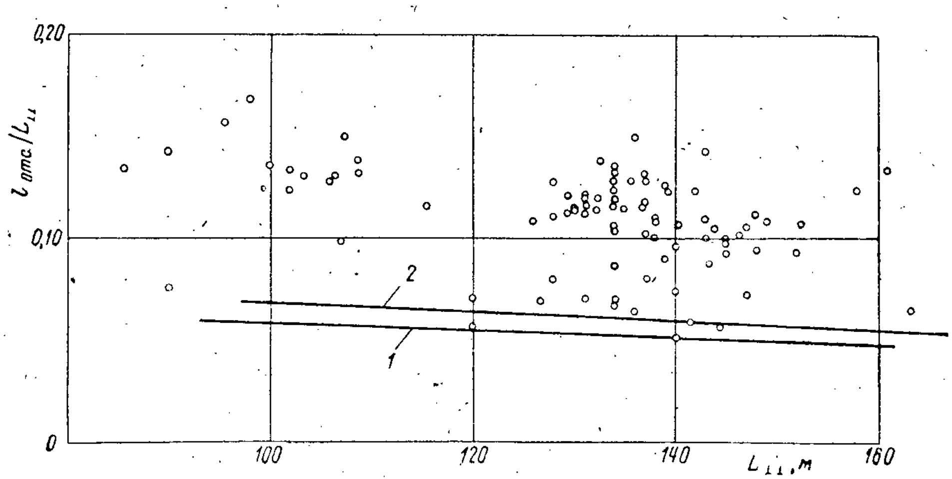

Рис. 15. Расчетная длина повреждения и фактические длины наименьших отсеков построенных в последние годы судов.

1 — относительная длина повреждения по Конвенции 1948 г.

$$\frac{l_n}{L_{\perp\perp}} = \frac{0{,}03L_{\perp\perp} + 3{,}05}{L_{\perp\perp}};$$

2 — рекомендуемая относительная длина повреждения

$$\frac{l_n}{L_{\perp\perp}} = \frac{0{,}04L_{\perp\perp} + 3{,}05}{L_{\perp\perp}}.$$

выполнения требований по числу затапливаемых отсеков за счет чрезмерно близкой расстановки переборок.

Увеличение расчетной длины пробоины ведет в ряде случаев к увеличению степени безопасности судна, поэтому, исходя из стремления к разумному и не связанному с ухудшением других качеств судов ужесточению требований к непотопляемости, целесообразно зафиксировать в пересмотренной Конвенции несколько большую, нежели в Конвенции 1960 г. расчетную длину пробоины.

Рассмотрение статистических сведений о фактической наименьшей длине отсеков (за исключением фор- и ахтерпика) плавающих судов (рис. 15) показывает, что такое увеличение возможно.

Представляется целесообразным принять расчетную длину пробоины; равной 0,04 длины судна плюс 3,05 *м*, опустив содержащееся в Конвенции 1960 г. ограничение предельной длины пробоины величиной 10,67 *м*.

Предлагаемое увеличение наибольшей расчетной длины пробоины на 1% длины судна не приведет, как следует из рис. 15, к каким-либо изменениям в существующей практике расстановки переборок.

Расчетная глубина пробоины для пассажирских судов должна быть увеличена до половины ширины судна, причем форма пробоины в плане может быть трапецевидной, как это предлагалось, например, в предложениях США по пересмотру Конвенции 1948 г.

Вертикальный размер пробоины должен приниматься от основной плоскости до палубы переборок включительно, как это и требуется Конвенцией 1960 г.

АНАЛИЗ ВОЗМОЖНОСТИ ОБЕСПЕЧЕНИЯ НЕПОТОПЛЯЕМОСТИ СУХОГРУЗНЫХ СУДОВ ДЛИНОЙ 90 *м*

На Международной конференции по охране человеческой жизни на море, проходившей в Лондоне летом 1960 г., Советская делегация предлагала обеспечивать непотопляемость морских грузовых судов при затоплении одного любого отсека, начиная с длины 90 *м*.

В качестве дополнительного обоснования осуществимости этого предложения ниже приводятся результаты расчетов по выявлению высоты корпуса, необходимой для получения у судов длиной 90 *м* требуемой величины остающегося после аварии надводного борта. Произведенное сопоставление необходимой высоты борта с минимальной, получающейся с учетом Правил о грузовой марке, позволяет установить, какое увеличение высоты борта, а следовательно, количества затрачиваемого металла и стоимости постройки будет иметь место в случае предъявления требований к непотопляемости судна длиной 90 *м* при различной протяженности надстроек, при разной длине машинного отделения и при определенном расположении его по длине судна. Показано также, к какому уменьшению дедвейта из-за увеличения веса корпуса может привести обеспечение непотопляемости судов такого размера.

I. Последовательность расчетов и исходные данные для их выполнения

Необходимая (по условию получения требуемой величины остающегося после затопления отсека надводного борта) высота корпуса определялась в результате нахождения положения аварийной ватерлинии для судна длиной 90 *м* с некоторыми средними соотношениями главных размерений и коэффициентами полноты. При выполнении расчетов по определению положения аварийной ватерлинии водоизмещение неповрежденного судна считалось неизменным, а борт — неограниченно высоким. После определения посадки судна с затопленным отсеком высота борта ограничивалась величиной, обеспечивающей при нормальной седловатости требуемое отстояние палубы от аварийной ватерлинии. Далее определялся вес корпуса при полученной высоте борта и находилось изменение этого веса по сравнению с тем, который имел место при минимально допустимой по правилам о грузовой марке высоте борта. Затем определялось изменение дедвейта и стоимости постройки судна.

Указанные расчеты выполнялись для трех различных длин машинного отделения при трех разных положениях его по длине. Минимально допустимая по правилам о грузовой марке высота надводного борта, которая учитывалась при расчете наименьшей возможной высоты корпуса, определялась при нескольких относительных длинах надстроек.

Расчеты производились применительно к судну, имеющему четыре трюма. Четырехтрюмное судно было выбрано потому, что почти 60% судов длиной от 80 до 100 *м* имеют четыре и более трюмов.[1]

При выполнении расчетов соотношения главных размерений и коэффициент общей полноты были приняты средними по существующим грузовым судам длиной около 90 *м* и равными:

отношение длины L к ширине B $\frac{L}{B} = 7{,}0$;

отношение ширины к осадке T $\frac{B}{T} = 2{,}2$;

коэффициент общей полноты $\delta = 0{,}70$.

При принятых $\frac{L}{B}$, $\frac{B}{T}$ и δ рассматриваемое судно длиной 90 *м* имеет следующие элементы:

водоизмещение объемное в пресной воде $V = 4680$ *м*³;
длина между перпендикулярами $L_{\perp\perp} = 90$ *м*;
ширина $B = 12{,}8$ *м*;
осадка $T = 5{,}8$ *м*.

По статистическим данным[2] длина машинного отделения $l_{м.о}$ составляет на судах длиной 80—100 *м* от 0,12 до 0,20 длины судна. Поэтому расчеты производились для судов длиной 90 *м*, имеющих относительную длину машинного отделения $\frac{l_{м.о}}{L}$, равную 0,12, 0,16 и 0,20. При этом рассматривались варианты с расположением машинного отделения между вторым и третьим, между третьим и четвертым и позади четвертого трюма.

В результате рассмотрения проектов построенных судов было принято, что длина форпика $l_ф$ равна $0{,}07L$ при среднем расположении машинного отделения, $0{,}09L$ при промежуточном и $0{,}11L$ — при кормовом.[3]

Относительная длина ахтерпика на всех судах практически одинакова и составляет примерно $\frac{l_а}{L} = 0{,}05$. Поэтому в расчетах было принято, что длина ахтерпика $l_а = 0{,}05L$.

При расчетах объема вливающейся в отсеки воды коэффициенты проницаемости объемов отдельных помещений принимались равными:
для трюмов выше двойного дна $\mu_т = 0{,}60$;
для машинных отделений выше двойного дна $\mu_м = 0{,}85$;
для пустых отсеков двойного дна $\mu_д = 0{,}98$;
для заполненных дизельным топливом отсеков двойного дна под машинным отделением (с учетом разницы удельных весов топлива и замещающей его при аварии воды) $\mu_{д.м} = 0{,}15$.

[1] Естественно, что обеспечение непотопляемости трехтрюмных судов длиной 90 *м* будет требовать большего увеличения высоты борта. Однако Администрации может быть предоставлено право освобождать те или иные суда от выполнения требований к непотопляемости, если осуществление этих требований практически нецелесообразно. Поэтому то обстоятельство, что на относительно небольшой части судов длиной 90 *м*, имеющих два или три трюма, обеспечение непотопляемости будет затруднительно, не может служить основанием к отказу от предъявления общего требования к таким судам.

[2] «Schiffbautechnik», 1957, № 11, стр. 641.

[3] Увеличение протяженности, а следовательно, и объема форпика при переходе от среднего к кормовому расположению машинного отделения объясняется необходимостью приема в него большего количества воды для получения приемлемой осадки носом в балластном пробеге.

В результате расчетов средние коэффициенты проницаемости объемов всех трюмов (кроме трюма № 1) и находящихся под ними пустых отсеков двойного дна принимались равными 0,63; коэффициент проницаемости объема отсека, составляющего трюм № 1, был принят равным 0,64 из-за обычно увеличиваемой в этом отсеке высоты двойного дна. Средний коэффициент проницаемости объема машинного отделения с находящимися под ним топливными отсеками двойного дна принимался равным 0,80.

Длина всех четырех трюмов при среднем расположении машинного отделения принималась одинаковой; при промежуточном и кормовом расположении машинного отделения, в тех случаях, когда это могло улучшить аварийную посадку, длины трюмов несколько менялись. (Такие случаи имели место при $\frac{l_{м.о}}{L} = 0{,}12$, когда находящийся в районе миделя трюм целесообразно было удлинять, сокращая соответственно длину наиболее неблагоприятно расположенных в отношении аварийного дифферента трюмов).

При определении изменения веса корпуса из-за увеличения высоты борта принималось, что этот вес растет пропорционально высоте борта в степени 0,5. Такой закон изменения веса корпуса в зависимости от высоты борта был принят в результате анализа имеющихся графиков и формул для его подсчета, причем был принят известный запас в сторону его увеличения. В частности, известные графики Рабена приводят к меньшему увеличению веса корпуса.

Изменение стоимости постройки судна длиной 90 *м* с увеличением высоты борта определялось путем расчета с использованием данных о фактической стоимости металлического корпуса, механизмов, оборудования и вспомогательных работ при постройке семи судов разного размера.

II. Результаты расчетов и их анализ

По результатам расчетов были построены графики, позволяющие оценить изменение дедвейта и стоимости постройки судна длиной 90 *м*, имеющего определенную длину и расположение машинного отделения, а также определенную относительную длину надстроек.

График, воспроизведенный на рис. 1, показывает, каким должно быть отношение высоты борта H к осадке T у четырехтрюмного судна длиной 90 *м* для того, чтобы остающийся после затопления надводный борт был бы равен одной тысячной длины судна (90 *мм*).[1]

График на рис. 2 показывает, каким должно быть у судна длиной 90 *м* минимально допустимое по правилам о грузовой марке отношение $\frac{H}{T}$ при различной длине надстроек $l_н$.

График на рис. 3 воспроизводит примерную зависимость уменьшения дедвейта с изменением отношения $\frac{H}{T}$ за счет увеличения высоты корпуса. Рис. 4 дает относительное увеличение стоимости судна при увеличении отношения $\frac{H}{T}$ за счет высоты корпуса.

[1] На конференции в Лондоне Советская делегация предлагала назначать минимальный остающийся после аварии надводный борт зависящим от размеров судна, так как при обычном требовании иметь после аварии надводный борт, равным 76 *мм* относительный запас плавучести крупных судов становится меньше, что противоречит основному принципу придания большей безопасности большим по размерам судам. Поскольку в данном случае $\frac{L}{1000}$ очень близко к 76 *мм*, сделанные далее выводы могут быть распространены и на суда, у которых аварийный надводный борт равен 76 *мм*.

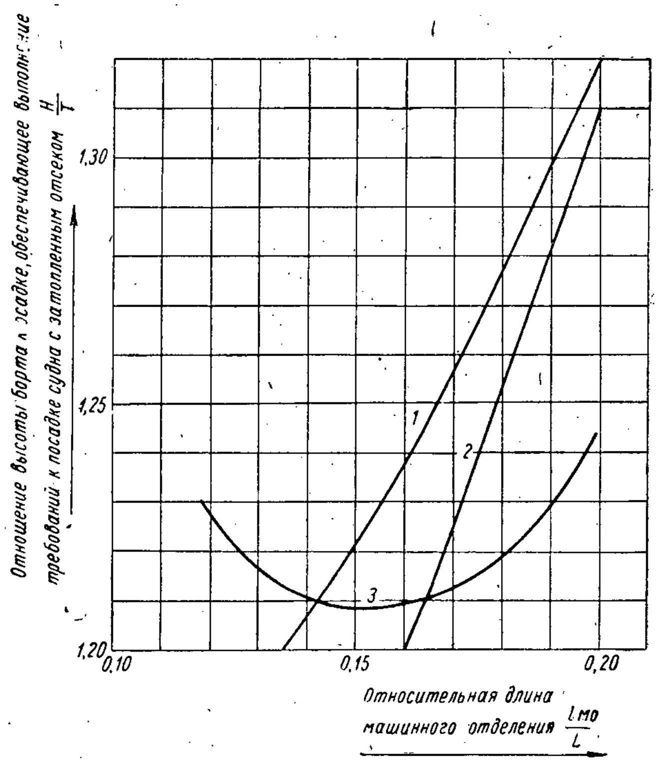

Рис. 1. Отношение высоты борта к осадке четырехтрюмного судна длиной 90 *м*, необходимое для получения требуемой высоты остающегося после затопления одного отсека надводного борта.

1 — машинное отделение между 3 и 4 трюмами
2 — машинное отделение в корме
3 — машинное отделение между 2 и 3 трюмами

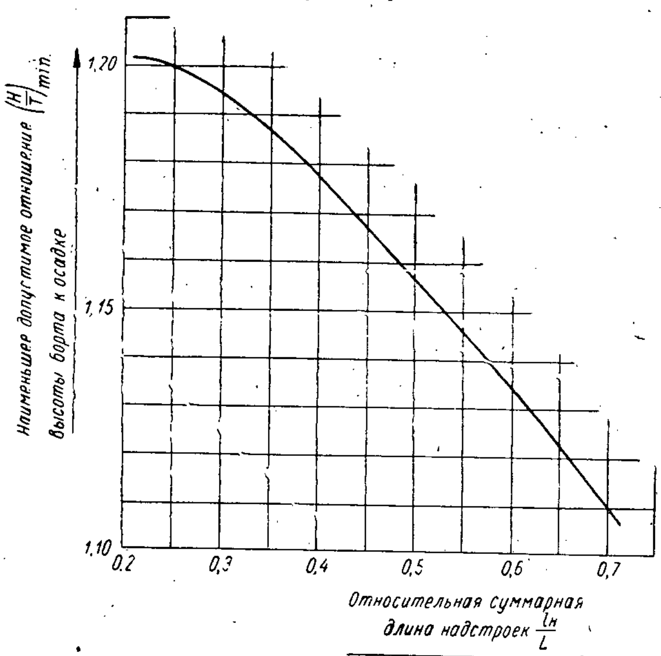

Рис. 2. Наименьшее допустимое по действующим правилам о грузовой марке отношение высоты борта к осадке судна длиной 90 *м* при разной относительной суммарной длине надстроек.

Сопоставляя требуемое по правилам о грузовой марке отношение $\left(\frac{H}{T}\right)_{\min}$ (рис. 2) с отношением $\frac{H}{T}$, необходимым по условиям обеспечения непотопляемости (рис. 1), можно найти отношение $\left(\frac{H}{T}\right):\left(\frac{H}{T}\right)_{\min}$, по которому с помощью рис. 3 и 4 могут быть определены потери дедвейта и увеличение стоимости постройки судна.

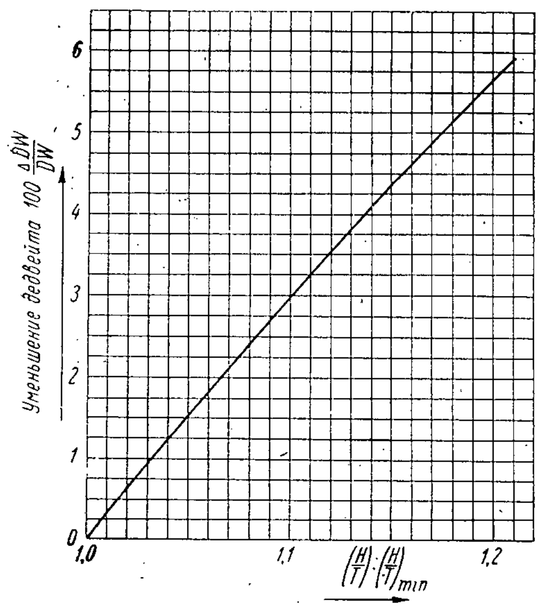

Рис. 3. Уменьшение дедвейта судна длиной 90 *м* при увеличении отношения $H:T$ за счет высоты борта.

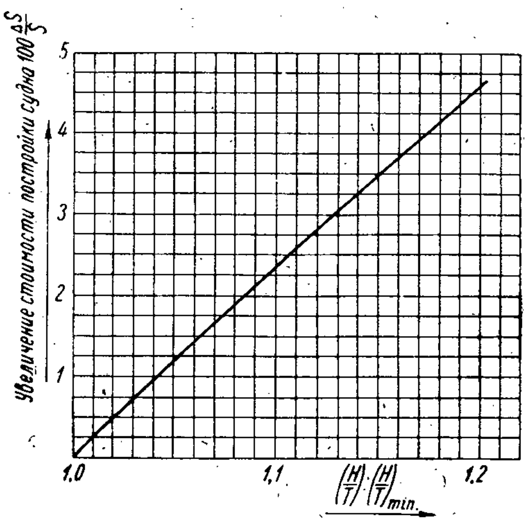

Рис. 4. Увеличение стоимости постройки судна длиной 90 *м* при увеличении отношения $H:T$ за счет высоты борта.

Так, например, при относительной длине расположенного в районе миделя машинного отделения $\frac{l_{\text{м. о}}}{L}=0{,}15$ из условия обеспечения непотопляемости отношение $\frac{H}{T}$ должно быть не менее 1,21.

В то же время по правилам о грузовой марке при надстройках, составляющих 0,4 длины судна, отношение $\left(\frac{H}{T}\right)_{\min}$ могло бы быть принято равным 1,176.

При $\left(\frac{H}{T}\right):\left(\frac{H}{T}\right)_{\min}=\frac{1{,}21}{1{,}176}=1{,}03$ увеличение стоимости судна составит 0,7%, а уменьшение дедвейта — 0,9%.

При наиболее часто встречающихся на судах длиной около 90 *м* относительных длинах надстроек и машинных отделений, при наихудшем по аварийной посадке промежуточном расположении машинного отделения увеличение стоимости постройки из-за обеспечения непотопляемости за счет увеличения высоты борта не превзойдет $1\div1{,}5\%$; дедвейт при этом уменьшится примерно на столько же.

Если учесть, что увеличение высоты корпуса приводит к некоторому увеличению объемов трюмов, позволяющему полнее использовать грузоподъемность в случае перевозки грузов с большой удельной погрузочной кубатурой, то, с учетом уменьшения потерь судов при авариях, обеспечение непотопляемости четырехтрюмных судов длиной 90 *м* экономически оправдано.

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ОБ УНИФИКАЦИИ РАСЧЕТОВ ОСТОЙЧИВОСТИ НЕПОВРЕЖДЕННЫХ СУДОВ

Предлагается унифицировать расчетные варианты нагрузки судов и установить единообразные правила расчетов остойчивости с целью сделать материалы расчетов остойчивости морских судов в разных странах взаимно сопоставимыми.

I. Варианты нагрузки

Остойчивость пассажирских судов должна быть проверена при следующих вариантах нагрузки судна:

1. Судно в полном грузу с полной нормой запасов и с полным количеством классных и палубных пассажиров с багажом.
2. Судно в полном грузу и с полным количеством классных и палубных пассажиров с багажом, но с 10% запасов.
3. Судно без грузов, но с полной нормой запасов и с полным количеством классных и палубных пассажиров с багажом.
4. Судно, как в третьем варианте нагрузки, но с 10% запасов.

Остойчивость сухогрузных судов должна быть проверена при следующих вариантах нагрузки:

1. Судно в полном грузу при осадке по грузовую марку и наличии однородного груза, заполняющего грузовые трюмы, твиндеки, комингсы и шахты грузовых люков с полной нормой запасов и топлива и без жидкого балласта.
2. Судно, как и в первом варианте нагрузки, но с 10% запасов и топлива.
3. Судно в полном грузу, при осадке по грузовую марку и наличии легкого однородного груза (если таковой предусмотрен заданием), заполняющего грузовые трюмы, твиндеки, комингсы и шахты грузовых люков и размещенного на верхней непрерывной палубе, с полной нормой топлива и запасов.
4. Судно, как в третьем варианте нагрузки, но с 10% топлива и запасов.
5. Судно без груза с 10% топлива и запасов.

Остойчивость лесовозных судов должна проверяться при следующих вариантах нагрузки:

1. Судно с лесным грузом, обладающим предусмотренным заданием погрузочным объемом и размещенным в трюмах и на палубе, при осадке по грузовую марку с полной нормой топлива и запасов.
2. Судно, как и в первом варианте нагрузки, но с 10% топлива и запасов.
3. Судно с лесным грузом, обладающим наибольшим предусмотренным заданием погрузочным объемом и размещенным в трюмах и на палубе с полной нормой запасов и топлива.
4. Судно, как в третьем варианте нагрузки, но с 10% запасов и топлива.
5. Судно без груза с 10% запасов и топлива.

Остойчивость наливных судов, перевозящих жидкие грузы, должна проверяться при варианте нагрузки: судно с полным количеством груза, но с 10% нормы запасов и топлива.

Остойчивость рыболовных судов должна проверяться при следующих вариантах нагрузки:

1. Выход на промысел с полной нормой топлива и запасов.
2. Возвращение с промысла с полным уловом в трюме и на палубе и с 10% нормы топлива и запасов.
3. Возвращение с промысла с 20% улова в трюме или на палубе, с 70% нормы льда и соли и с 10% нормы топлива и запасов.

Для судов, промышляющих сетями, должны быть предусмотрены во 2-м и в 3-м вариантах нагрузки мокрые сети на палубе.

4. Судно на промысле с подробными данными о состоянии нагрузки, соответствующем опыту эксплуатации в разных странах.

II. Диаграммы остойчивости

1. Диаграммы статической и динамической остойчивости строятся одним из общепринятых в теории корабля способов с учетом влияния свободных поверхностей жидких грузов при посадке судна по ватерлинию, параллельную конструктивной.

Масштаб чертежа корпуса должен быть достаточно крупным, так чтобы ширина корпуса выражалась отрезком длиной не менее 250 *мм*. При построении корпуса разрешается учитывать толщину деревянного палубного настила.

2. При расчете плеч остойчивости формы могут быть учтены те надстройки, которые рассматриваются Международной Конвенцией о грузовой марке при определении высоты надводного борта как закрытые, т. е. удовлетворяют Правилам XLI, XLII, XLIII и XLIV этой Конвенции. В качестве расчетной длины закрытых надстроек следует принимать действительную их длину, а в качестве расчетной высоты — действительную их высоту.

Если надстройки не удовлетворяют требованиям п. d Правила XLI Конвенции о грузовой марке, т. е. двери в переборках надстроек на непрерывную палубу являются единственными выходами на палубу и при этом верхняя кромка комингсов дверей надстроек погружается в воду у судна в полном грузу при крене, меньшем 60°, то расчетная высота надстроек над непрерывной палубой условно принимается равной половине действительной ее высоты. Если верхняя кромка комингсов дверей у таких надстроек погружается в воду у судна в полном грузу при крене, равном или большем 60°, то надстройка может рассматриваться как закрытая и расчетная высота ее над непрерывной палубой принимается равной действительной высоте.

3. При расчете плеч остойчивости формы могут быть также учтены рубки, находящиеся на верхней палубе при условии, если:

а) Администрация удостоверяется в соответствии их конструкции правилам постройки морских судов, которыми она руководствуется;

б) они имеют водонепроницаемые двери, прочность которых соответствует прочности закрытий 1 класса;

в) они имеют дополнительный выход на вышележащую палубу.

При наличии всех перечисленных условий рубки засчитываются на полную свою высоту.

Если прочность рубок удовлетворяет Правилам постройки, которыми руководствуется Администрация, и устройство наружных дверей соответствует закрытиям 1 класса, но отсутствует дополнительный выход на вышележащую палубу, то такие рубки при расчете плеч остойчивости формы не учитываются вовсе, но находящиеся под ними отверстия в палубе судна условно считаются закрытыми вне зависимости от того, имеют они закрытия или нет.

Рубки, не имеющие прочных закрытий 1 класса, а также рубки, прочность конструкций которых не удовлетворяет «Правилам постройки» при расчете плеч остойчивости формы не принимаются во внимание. Находящиеся под ними отверстия в палубе и сходные люки считаются закрытыми, если их комингсы и устройства для закрывания удовлетворяют Правилам XVIII и XXI Конвенции о грузовой марке.

Отдельно стоящие сходные рубки (тамбуры) входов в подпалубные помещения в расчетах плеч остойчивости формы не учитываются.

Отверстия под деревянными сходными рубками (тамбурами) на металлических палубах считаются открытыми.

Рубки, расположенные на палубах надстроек или рубок при расчетах плеч остойчивости формы не учитываются, но расположенные под ними отверстия условно считаются закрытыми.

4. Угол заливания через считающиеся открытыми отверстия в борту, палубе или надстройке судна учитывается путем обрыва или уступа диаграммы статической остойчивости.

При наличии считающихся открытыми отверстий в борту или палубе судна, через которые вода может попадать внутрь корпуса судна, диаграммы остойчивости считаются действительными до угла крена, соответствующего началу заливания через эти отверстия. При наклонениях судна, превышающих указанный угол крена, судно считается полностью утратившим остойчивость и диаграммы остойчивости обрываются при угле заливания.

Если в концевых переборках или палубах надстроек судна имеются считающиеся открытыми отверстия, через которые вода может поступать внутрь надстроек и затем в расположенные ниже надстроек помещения судна, диаграммы остойчивости считаются действительными до угла крена, соответствующего началу заливания через отверстия надстроек. При наклонениях, превосходящих указанный угол крена, судно считается полностью утратившим остойчивость.

Если распространение воды, поступающей в надстройку через считающиеся открытыми отверстия ограничивается лишь данной надстройкой, или частью ее, то такая надстройка или часть ее при углах крена, превышающих угол начала заливания воды через отверстия, рассматривается как несуществующая. Диаграмма статической остойчивости при этом получает уступ, а диаграмма динамической остойчивости — излом.

Величину угла крена, соответствующего началу заливания через отверстия, рекомендуется определять при выполнении расчетов плеч остойчивости формы и строить график угла заливания в функции от водоизмещения судна.

К считающимся открытыми отверстиям следует относить всякие отверстия в верхних палубах или бортах корпуса, а также в палубах, бортах и переборках надстроек, устройства для закрывания которых в отношении прочности и надежности не удовлетворяют требованиям Правил X—XVI, XIX, XX, XXVI, XXVIII, XLIII—XLV Конвенции о грузовой марке.

Малые отверстия, как например, отверстия для прохождения тросов специальных устройств, талей, глубоководных якорей, а также отверстия шпигатов, сливных или санитарных труб, фактически не влияющие на остойчивость при динамическом крене судна, не должны рас-

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сматриваться как открытые и угол крена, соответствующий входу их в воду, не считается углом заливания.

При расчете плеч остойчивости на больших углах крена лесовозных судов допускается засчитывать объем палубного груза, причем расчетная высота его должна приниматься равной 0,75 действительной высоты, но не выше палубы надстроек первого яруса.

5. В число цистерн, учитываемых при подсчете влияния жидкого груза на остойчивость при больших углах крена включаются цистерны каждого вида жидкого груза (и балласта), в которых по условиям эксплуатации могут быть одновременно свободные поверхности.

При этом рекомендуется составить одну расчетную комбинацию из одиночных цистерн или их сочетаний по каждому виду жидкого груза.

Из числа возможных в эксплуатации сочетаний цистерн по отдельным видам жидких грузов, либо одиночных цистерн следует выбирать такие, чтобы создаваемый ими суммарный кренящий момент ΔM_{30} от переливания жидкости при крене судна 30° имел наибольшее значение.

При этом во всех случаях поправка вычисляется при заполнении цистерны на 50% по ее емкости.

Рекомендуется вычислять величину ΔM_{30} для каждой одиночной цистерны по формуле

$$\Delta M_{30} = vb\gamma\sqrt{\delta}\,\bar{l}_{30},$$

где v — полная емкость цистерны, $м^3$,

b — габаритная ширина цистерны, $м$,

γ — объемный вес жидкого груза в цистерне, $т/м^3$,

$\delta = \frac{v}{abc}$ — коэффициент полноты цистерны,

a — габаритная высота цистерны, $м$,

c — габаритная длина цистерны, $м$,

$\bar{l}_{30}$ — безразмерный коэффициент, определяемый по таблице в зависимости от отношения b/a.

Таблица

Значения безразмерного коэффициента $\bar{l}_{30}$ к учету влияния жидких грузов на остойчивость при больших наклонениях

b/a	20	10	5	2	1	0,5	0,2	0,1
$\bar{l}_{30}$	0,111	0,113	0,114	0,094	0,049	0,024	0,010	0,006

Промежуточные значения определяются интерполяцией (линейной или графической).

В расчет не включаются цистерны, удовлетворяющие условию

$$vb\gamma\sqrt{\delta}\,l_{30} < 0{,}01D_{\min},$$

где $D_{\min}$ — минимальное водоизмещение судна для перечисленных выше случаев нагрузки.

Обычные остатки жидких грузов в опорожненных цистернах в расчетах не учитываются.

ПРИНЦИПЫ СОСТАВЛЕНИЯ ИНФОРМАЦИИ ОБ ОСТОЙЧИВОСТИ

В условиях эксплуатации судна его остойчивость существенно зависит от способа размещения грузов, наличия свободных поверхностей жидкостей в цистернах, надлежащего закрытия отверстий и других факторов, находящихся в распоряжении капитана. Поэтому ответственность за остойчивость судна в эксплуатации возлагается на капитана.

Для несения этой ответственности капитан должен располагать согласованной с Администрацией информацией об остойчивости вверенного ему судна, составленной на основании опыта кренования и содержащей следующие материалы:

1. Общую характеристику остойчивости судна и ряд практических указаний, учитывающих особенности судна, и рекомендации, которыми судовой персонал мог бы руководствоваться при эксплуатации судна, как например:

а) указания для составления плана погрузки, при котором остойчивость судна не уменьшалась бы ниже допустимого предела;

б) указания относительно ограничения эксплуатации судна определенным районом или сезоном плавания, условиями погоды или состоянием моря, предельные баллы волнения и силы ветра, при которых требуется соблюдение специальных предосторожностей при управлении судном;

в) рекомендации в отношении ограничения условий маневрирования, такие как ограничение скорости хода при повороте, необходимость избегать условий резонанса при качке, опасность хода на попутной волне со скоростью, близкой к скорости бега волн и т. п.;

г) эксплуатационные рекомендации, такие как порядок балластировки, особенно жидким балластом, наблюдение за низко расположенными открытыми иллюминаторами, борьба с обледенением, задраивание дверей и других отверстий в палубе и надстройках, ограничение высоты палубного груза лесовозов и т. д.

2. Данные, характеризующие остойчивость судна в типичных условиях нагрузки; использование этих данных позволяет судовому персоналу сразу, без всяких расчетов, количественно оценить остойчивость судна при наиболее часто встречающихся в эксплуатации состояниях нагрузки.

3. Типовые схемы, вспомогательные таблицы и графики, рабочие бланки и необходимые указания для самостоятельного проведения судовым персоналом расчетов остойчивости при нетипичных условиях нагрузки; эти схемы по возможности должны быть максимально просты и компактны.

4. Предельные значения метацентрической высоты при любой осадке судна или водоизмещении, позволяющие установить судовому персоналу при самостоятельном выполнении расчетов, является ли

вычисленная остойчивость достаточной. Вместо метацентрической высоты в информации могут быть приведены предельные значения возвышения центра тяжести судна над килем либо статического момента веса по высоте.

5. Различные дополнительные материалы и справочные данные, помогающие судовому персоналу получить более полное и точное суждение об остойчивости судна.

Рекомендуется применение специальных приборов и приспособлений, облегчающих судовому персоналу самостоятельное определение остойчивости судна при нетипичных условиях нагрузки.

СОДЕРЖАНИЕ

PROPOSALS

OF THE UNION OF SOVIET SOCIALIST REPUBLICS SUBMITTED TO IMCO SUB-COMMITTEE ON SUBDIVISION AND STABILITY PROBLEMS

USSR PROPOSALS FOR WORK OF SUB-COMMITTEE ON PROBLEMS OF SUBDIVISION AND INTACT STABILITY

In the opinion of the USSR Government the fulfillment of Recommendation 6, 7 and 8 of the Conference on Safety of Life at Sea 1960 should be executed by a number of consiquent stages.

At the first stage of this work the Sub-Committee on problems of subdivision and intact stability is to discuss and agree only general principles for the improvement in the system of criteria used for estimating the ship's subdivision, general principles of intact stability standards, principles of drawing up the information on stability along with principal problems of application of subdivision standards to cargo ships.

If these principal problems concerning Recommendation 6, 7 and 8 are agreed with, the Sub-Committee will be readily able to point out those additional calculations and investigations which will be necessary to be performed by identical methods in the member — countries of the Sub-Committee to specify some details and to fix concrete numerical values of rated parameters. The second stage of the Sub-Committee's work would cover the examination of above mentioned calculation and investigation results.

In connection with the aforesaid the USSR Government submits to the Sub-Committee on problems of ship's subdivision and intact stability the suggestions as follows:

1. Recommendation 6:

1.1 Adopted by the 1960 Convention the indirect regulation of damage draught by means of a subdivision factor should be replaced by the direct assignment of the minimum permissible freeboard or buoyancy reserve remaining after a definite number of adjacent compartments flooded. Moreover the freeboard or buoyancy reserve remaining after damage should be so fixed that the ratio of buoyancy reserve of a damaged ship to water volumes flowing into the hull was regulary and contineously increased with the increase of the ship's size and a number of passengers carried.

The necessity to take into consideration during damage freeboard determination some other factors such as machinery parameters and rest factors being taken into account in calculating criteria of service now is doubtful and needs discussing.

1.2. Specified by the 1960 Convention the provision concerning the rating of stability in damaged conditions by regulating a residual metacentric height remaining after damage and angles of heeling should be supplemented by requirements for the diagram of stability in damaged conditions.

2. Recommendation 7:

2.1. Intact stability should be sufficient to prevent the capsizing of a ship under the combined effect of waves and wind with a force taken in accordance with the navigation area. Besides that, characteristics of stability diagrams should be regulated (angle of vanishing point, maximum arm, heeling angle corresponding to maximum arm).

2.2. Requirements for intact stability first of all should be provided for fishing ships and vessels of other cathegories no more than 100 m long.

2.3. Information on stability should include the data of stability in typical loading conditions as well as the data necessary for determination by the crew the sufficiency of stability in other service conditions possible in practice. In addition to, the information should involve recommendations concerning measures to be taken to ensure safety of a ship provided that her stability appears unsatisfactory due to this or that reason.

2.4. Since for full-value rating of stability it is significantly important to be aware of the external forces actually effecting upon a ship which could be estimated only with complete data available on sea waves and wind, it is necessary to establish the exchange with appropriate data in possession of some countries.

Among desirable information there is data on the reiteration of the wind of different force and direction, on the height and period of wind waves following it and swell with the indication of their direction as well as statistic data on ships heading in relation to the wind direction and to heavy seas.

3. Recommendation 8:

3.1. The freeboard of cargo ships 90 m in length and upwards with any one compartment flooded according to calculations is to be equal to no less than one thousandth of the ship's length while characteristics of damage stability are to be as those of passenger ships which withstand under the Convention Rules the flooding of any one compartment.

Inadequacy to these or those requirements for the subdivision of cargo ships may be permitted by the Administration only in cases when the requirements incompatible with structural characteristics of a ship stipulated by specificity of her service. In ships of length less than 90 m requirements for damage draught and stability should be complied with to the extent which does not affect the ship's performances.

The Government of the USSR submits to the Sub-Committee the reports «On the criteria of subdivision in ships», «Analysis of the possibility of compliance with one-compartment Standard of subdivision for Dry-cargo Ships 90 m long» as well as existing in the USSR «Stability Standards of Sea-Going and Estuary Ships», recommendations «Concerning the Unification of the Estimation of Intact Stability» and «Principles of Drawing up the Information on Stability».

ON THE CRITERIA OF SHIPS SUBDIVISION

The system of criteria of subdivision accepted by the International Convention on the Safety of Life at Sea of 1960 has the following deficiencies:

1. The freeboard remaining after damage though it is the basic factor ensuring the safety of a damaged ship, is assigned by the Convention in an indirect manner by means of the value of the subdivision factor. This deprives us of the possibility to judge as to the actual position of a damaged ship in relation to the water surface.

At the same time in cases of an asymmetrical and symmetrical flooding of compartments, when the metacentric height after damage appears to be negative, the residual freeboard is assigned by the Convention directly.

Such a dual method of approach cannot but be considered fallacious by itself, but the method of calculating the factor of subdivision, as given in the Convention, is altogether conventional and rather cumbersome.

For the definition of the criterion of service and, hence, of the factor of subdivision, it is necessary to know a number of values (such as, for instance, the volumes of the crew accommodation and machinery space, the number of passenger berths below and above the bulkhead deck) the determination of which is practically impossible in the early stages of designing when the problems of subdivision are solved.

It should also be borne in mind that the empirical formulae, once suggested for the determination of the criterion of service have now become obsolete, as the correlations of volumes according to which this criterion is to be evaluated have changed in connection with more advanced and smaller in size propulsion machinery coming into existance as well as due to the improvement of the extent of comfort provided for the passengers and the crew on boardship.

Moreover, the curve of the floodable lengths traced in the conventional way and used for the reckoning of the subdivision of the ship, allows for some errors in the end subdivision these errors being not dangerous (Fig. 1).

2. The insertion into the 1960 Convention of a demand for a positive metacentric height of not less than 2″, has considerably increased the degree of the safety of ships. Nevertheless, the rejection of the USSR proposal that the average metacentric height (being not less than 2″) should be given in fractions of the breadth of the ship, leads to the fact that larger ships find themselves in less favourable condition than smaller ones. Really, the principal reason for the demand of getting a positive metacentric height in accordance with the estimate made after flooding lies in the fact that the possibility of compensating inevitable errors connected with the definition of the volume of the flooding water, the position of its gravity center and the momentum of the free surface area. With the growth of the area of the flooded compartment the abso-

lute value of such errors increases, and, therefore, with an equal margin of 2″, large and small ships will find themselves in a different position as to their safety.

3. The present Convention does not essentially standardize the heeling angle until a ship in damaged conditions and with unsymmetrically flooded compartments is righted up. However in some cases before any equalization measures have been taken the heeling angle can be so large that fighting for the endurance of the ship (her uprighting included) as well as the rescuing of persons on board might prove to be impossible.[1]

4. Requirements included in the Convention are connected, in the main, only with the initial stability of a damaged ship and, therefore, compliance with these requirements cannot be considered as a guarantee

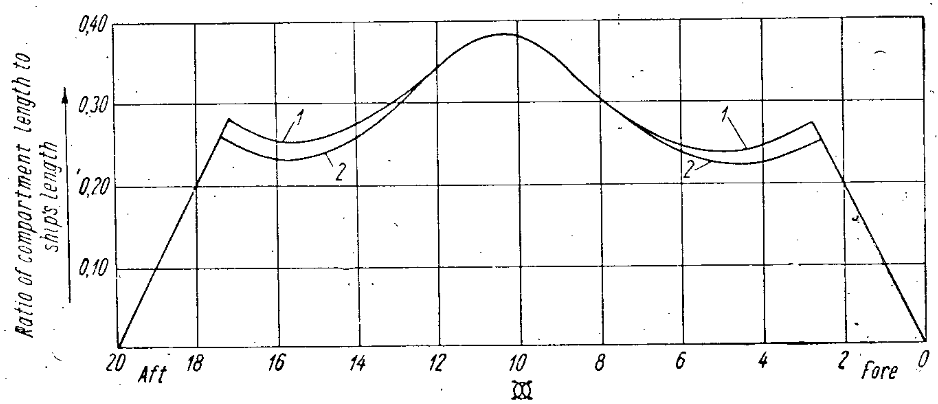

Fig. 1. Curves of relative floodable compartment lengths of the ship where permeability $\mu = 0.63$; $\delta = 0.70$; $\frac{H}{T} = 1.4$.

1 — curve plotted according to estimation of ship balance position by means of Bonjean diagram where $\mu = 0.63$; 2 — curve plotted by multiplication of values for floodable compartment length according to estimation of ship balance position by means of Bonjean diagram where $\mu = 1.0$ by ratio 1.0 : 0.63.

for the damaged ship's safety. The stability curve for a ship with a leakage might appear totally unacceptable, notwithstanding her considerable initial metacentric height as well as a permissible heeling angle (Fig. 2.).

The enumerated drawbacks of the Convention as regards the subdivision assignment can be eliminated, provided the ship is considered unsinkable, if:

— the freeboard or reserve buoyancy remaining after a definite number of compartments (one, two or three, depending on the dimensions and the destination of the ship) had been flooded, is not less than some definite value;

— the metacentric height in damage condition is positive and not lower than a certain value varying with the dimensions of the ship;

— the heeling angle at an unsymmetrical flooding does not exceed certain predetermined maximum values up to the moment when arrangements are made for an uprighting of the ship and after its realization;

— the stability curve of a damaged ship provides for a minimum permissible degree of safety when the external heeling moments act upon her.

For a practical application of these criteria it is necessary to establish:

[1] As an example confirming the validity of the aforesaid may be mentioned a big passenger liner, whose heeling angle at unsymmetrical flooding of boiler rooms reaches 28°.

— the smallest admissible from the point of view of safety freeboard or buoyancy reserve, remaining after the emergency;
— the smallest admissible metacentric height, taking into account the errors springing up at its definition: during a symmetrical flooding of a compartment or compartments of a ship;
— the largest admissible heeling angle at an unsymmetrical flooding of compartments preceding and following the uprighting of the ship's heel;
— the characteristics of the stability diagram of a damaged ship, allowing for its being considered sufficient from the point of view of securing the ship's safety;

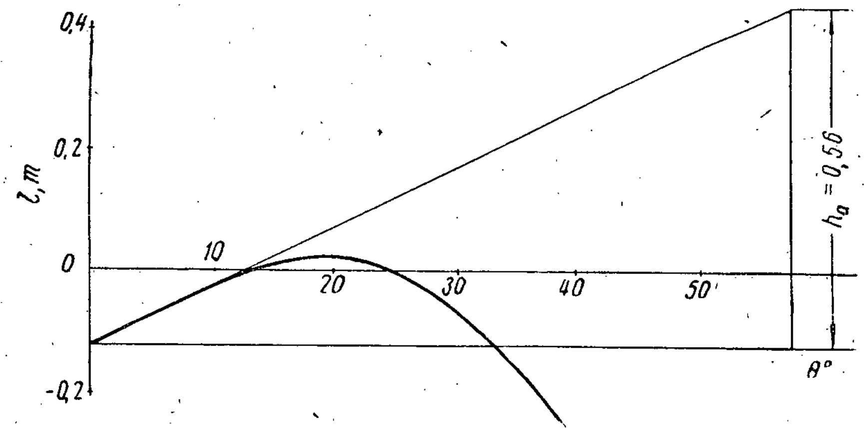

Fig. 2. Unsatisfactory diagram of damaged stability under considerable initial metacentric height ($h_a = 0{,}56$ *m*) and permissible angle of static list ($\Theta = 14°$).

Characteristics of the ship: length $L_{\perp\perp} = 76.8$ m; width B = 12,6 m, moulded depth H = 5,6 m; draught T = 3.6 m.

— the dimensions of ships of different designation, beginning with which it is technically possible and practically rational to demand settled characteristics of an established trim and stability.

Besides, the dimensions of a rated hole ought to be revised (as to its length, height and depth) on which very often depends the grade of unsymmetricity of the flooding as well as the grade of the reduction of stability in damage.

I. Concerning the freeboard remaining after damage

The value obtained as a result of the reckoning of the subdivision of the freeboard remaining after damage determines the following factors of buoyancy reserve in damaged condition representing the basic factor permitting a damaged ship to remain afloat:
— wetness of a damaged ship in a rough sea;
— the reserve of stability in damaged condition since, with other equal conditions, the shape and area of the damaged ship's stability curve depend upon the depth of the freeboard.

Considering that there are no adequate data on ship damages as well as on the damaged ship condition in a rough sea, it is impossible to submit any proposals for radical alteration of the depth of the freeboard remaining after flooding of compartments in comparison with that which is to be achieved with a ship of a similar size and designation as a result of the reckonings of the 1960 Convention.

Nevertheless, in the transition to a direct assignment of freeboard remaining after damage, it is necessary to compensate for any evident errors in the calculation of the freeboard depth in the 1960 Convention.

In particular, it is considered wrong to assign the minimum admissible residual freeboard now obtained in the presence of the subdivision factor equal to 1, $^{1}/_{2}$ and $^{1}/_{3}$ — the same for ships of all dimensions and being equal to 3″.

To our minds, the residual freeboard remaining after damage should be at least such that the resulting buoyancy reserve be sufficient for compensating for the possible error while reckoning the bulk of the water flooded through the hole into the damaged compartment, connected with the approximate determination of factors of permeability.

In the existing practice of assigning a minimum residual freeboard depth independently of the ship dimensions, as equal to 3″, this condition is not fulfilled. Even if we put geometrically similar ships with similar dimensions of flooded compartments, even then the preservation of a similar freeboard will lead in connection with a rise in the dimensions of the ship to a reduction of the ratio of an average buoyancy reserve to the bulk of water flooded into the hull, and consequently to a reduction of the possibility of a compensation of errors in the reckoning of the subdivision of large ships. And if we take into consideration that together with the growth of the ships length the ratio of the freeboard depth to the draught increases, which leads to an increase of the maximum length of the flooding and to a further increase of the bulk of flooded water as well as to the reduction of the residual damage buoyancy reserve, then the groundlessness of retaining the requirement concerning the residual freeboard to be equal to 3″ in ships of any dimensions becomes quite evident.

In order to put geometrically similar ships of different dimensions under equal conditions as to the compensation of a possible error in the reckoning of the amount of water flowed into the ship hull, it is necessary to demand that a ship in a damaged condition should have a freeboard value directly proportional to some dimension of the ship, her length in particular. As to the ships that are not geometrically similar, the above mentioned demand should be fulfilled if the factor of proportionality in the formula, connecting the residual damage freeboard with the length of the ship should alter in relation to the ships depth to draught, length to draught rations as well as the block coefficients.

However, considering the desirability to simplify the requirements as well as the relatively negligible effect of the above mentioned factors on the result obtained, it is considered possible to assign the residual freeboard depending on the ship length only.

In connection with the above, it is considered reasonable to introduce into the Convention a requirement that the minimum freeboard of a damaged ship should not be equal to 3″, as it is mentioned in the present Convention, but just one thousandth of the ship length.

Referring to the ships for which the factor of subdivision at present is not equal to a unity, a half or one third, the present Convention automatically demands to ensure a different freeboard for the flooding of the compartments amidships and in the ship ends (Fig. 3).

This is due to the fact that while assigning a permissible length of a compartment as a definite part of the maximum floodable length, the freeboard remaining after the flooding of compartments, not located amidships, is increased to a greater extent due to the reduction not only in the mean draught, but in the trimming moment as well.

In this case the reserve of stability in a damaged condition appears to be considerably greater when the flooded compartments are those which have their centre located at approximately one fourth or one third of the length from the midship section (Fig. 4).

It seems not to be obligatory (in the transition to direct assignment of the freeboard in damaged condition) to keep to the requirement of

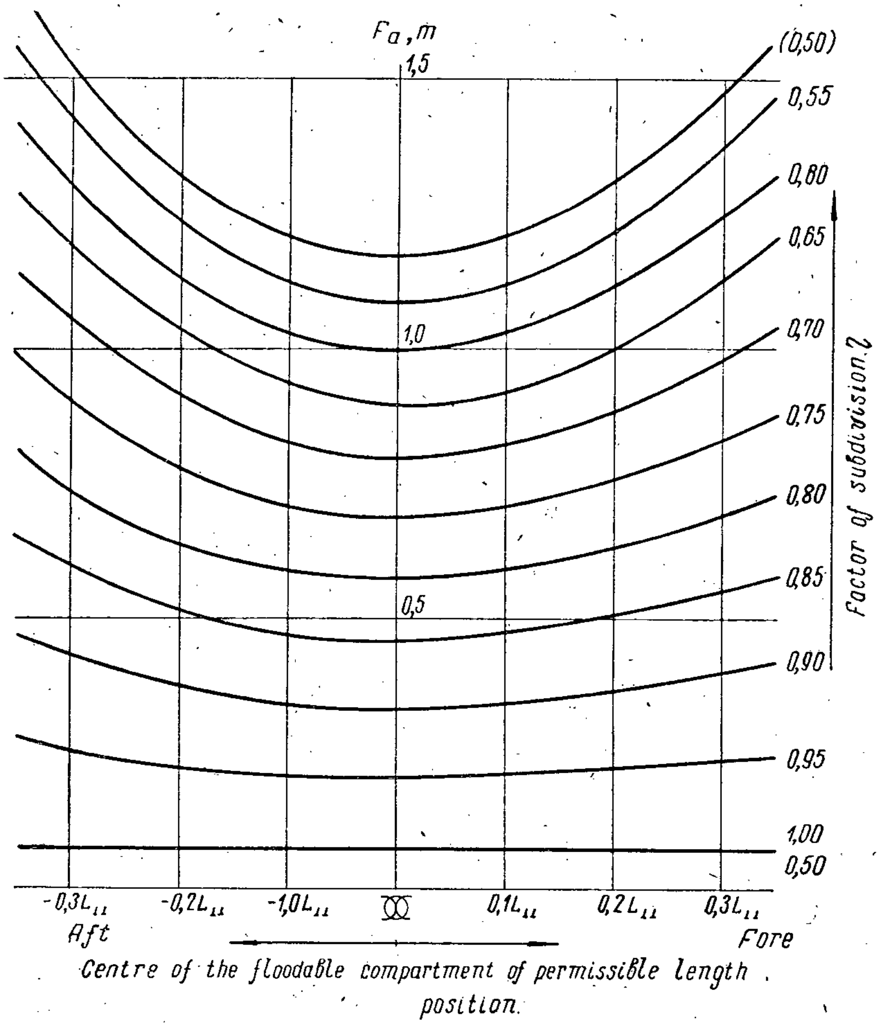

Fig. 3. Dependence of required freeboard F_a upon the position of the flooded compartment along the length of the ship and upon the factor of subdivision η.

Characteristics of the ship: length L = 100 m; moulded depth H = 6,65; draught T = 4,75 m.

having a different freeboard when flooding compartments in different parts along the ship length, as it is understood in the present Convention.

The reason for such a deduction is that in many cases (with the factor of subdivision equal to unit, one half and one third) the present Convention considers an equal freeboard to be sufficient at flooding compartments, located in any part along the ship length.

In general it is necessary to ascertain whether it does not correspond to the constant value of buoyancy reserve if it is to be considered not as an above water impermeable bulk, but as the weight of a cargo which may be taken on boardship at an admissible minimum value of freeboard.

Besides, the statistic data (Fig. 5) show that in large ships (it is just in such ships for which the factor of subdivision at present is less than a unity, but greater than a half) the actual length of compartments is less than the admissible limit value for the midship. As a result, the actual depth of the freeboard, with the midship compartments flooded, is greater than that permitted by the present Convention and is close to the freeboard depth remaining when the end compartments are flooded.

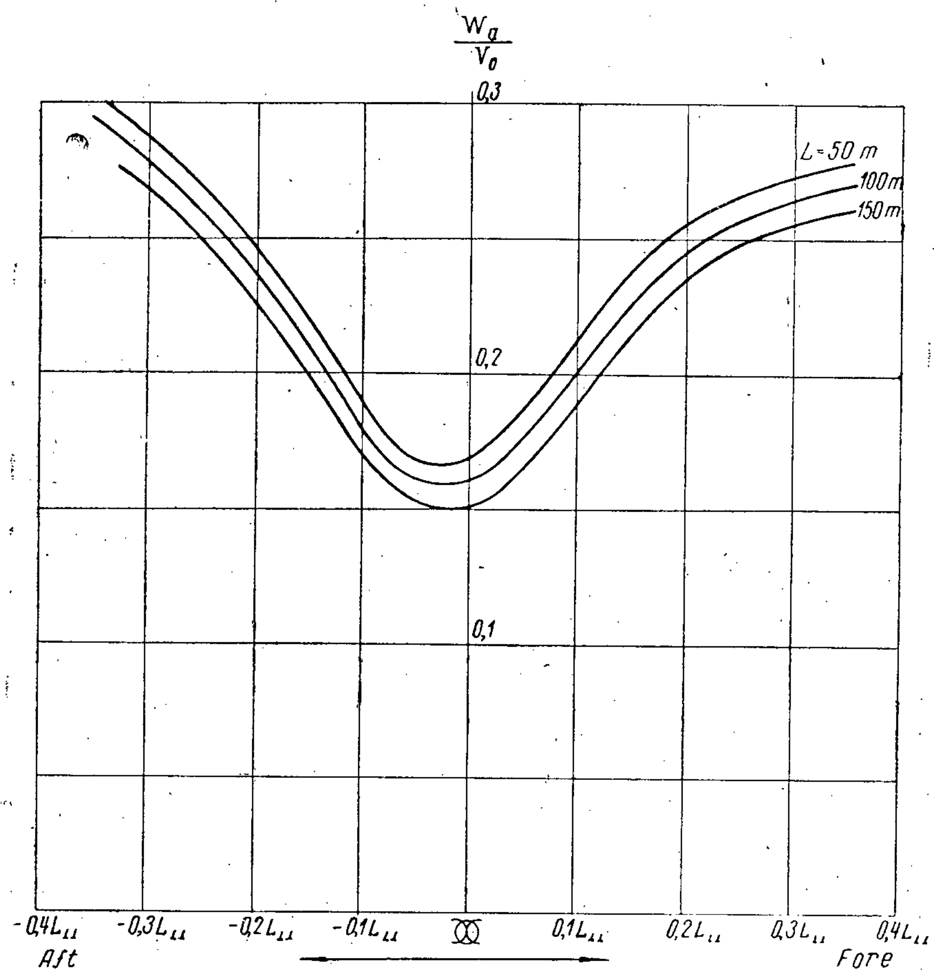

Fig. 4. Dependence of relative coefficient of buoyancy reserve of damaged ship upon the position of the flooded compartment along the length of the ship.

Characteristics of ships: L : H = 15; H : T = 1,4; factor of subdivision $\eta = 0{,}80$; W_a — reserve of buoyancy remained after damage of the ship; V_0 — volume displacement of intact ship.

From the aforesaid about the actually obtained freeboard depth of a damaged ship is follows that when assigning the depth of the residual freeboard it is expedient to proceed not from the freeboard depth at the flooding of midship compartments obtained from the reckoning in accordance with the present Convention, but from the freeboard depth remaining after the damaging of compartments having their centre at a distance of approximately a quarter of the ship length counting from the midship section.

As distinct from the present Convention in transition to a direct assignment of the freeboard depth of a damaged ship it appears rational not to take into account a number of factors, consideration of which being complicated enough, cannot be logically founded or leads to an insignificant alteration of the required freeboard depth (according to the 1960 Convention).

For making out the influences produced by different factors defining (according to the 1960 Convention) the freeboard depth remaining after damage, there was made a reckoning of the freeboard depth of ships of different lengths with altering the machinery spaces, the number of passengers and crew, the accommodations for each person and with a

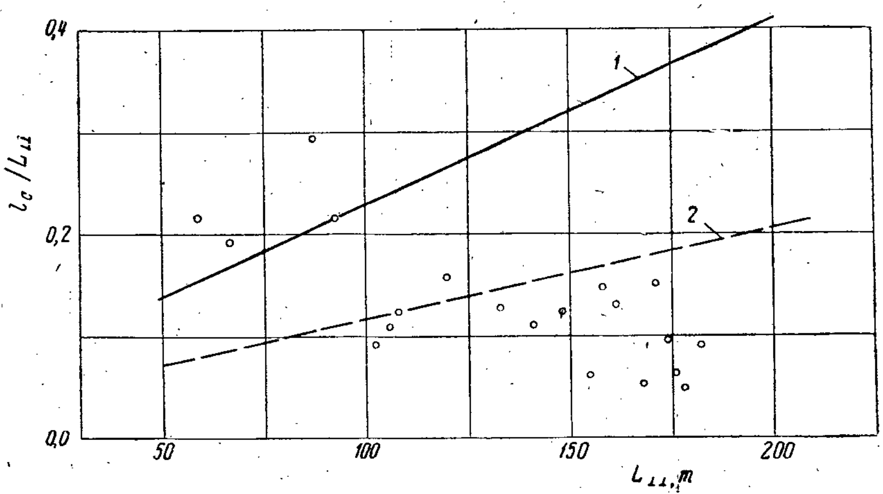

Fig. 5. Actual and permissible length of compartments situated amidships in passenger ships built in 1957—1958.

1 — relative floodable length of the compartment (factor of subdivision $\eta = 1{,}0$); 2 — relative permissible length of the compartment, when the factor of subdivision is $\eta = 0{,}5$. Floodable and permissible length have been determined for ships in which the ratio of length to moulded depth measured to bulkhead deck is 13,5 and the freeboard is minimum.

different number of passengers carried below and above the bulkhead deck.

The reckoning was carried out in conformity with the ships having a block coefficient $\delta=0.60$ and with a length to depth ratio of the ship side up to the bulkhead deck equal to 13.5. The coefficient of permeability of bulks was conditionally assumed to be equal to a unit.

The taking into account of the ratios of the bulks of machinery spaces to the hull below the margin line is considered to be inexpedient, though the influence of this ratio on the residual freeboard appears to be very considerable according to the 1960 Convention (Fig. 6).

When drawing up formulae for the definition of the criterium of the service it seems that the relative bulk of the machinery spaces grows in connection with the growth of the ship's speed, which is partly connected with the probability of a collision and the extent of the damage. One could as well take into consideration the increase of the ship's cost connected with the capacity of the ship's engines, which makes the sequel of such a ship's loss still more appreciable. It is probable that in relation to this fact, with the increase of the ratio of the volume of the machinery spaces to the volume of the hull below the lower margin line of the 1929 Convention, and later — the 1948 and 1960 Conventions required the increase of the freeboard depth remaining after damage. But the probability of a collision and the extent of the damage depend not only on the speed of the ship the subdivision of which is being checked, but (for the most part) on the speed and dimensions of the ship the former will collide with.[1] Besides, it should be borne in mind that at present it is difficult to determine the direct dependence between the speed of the ship and the volume of machinery spaces, for the reason that cer-

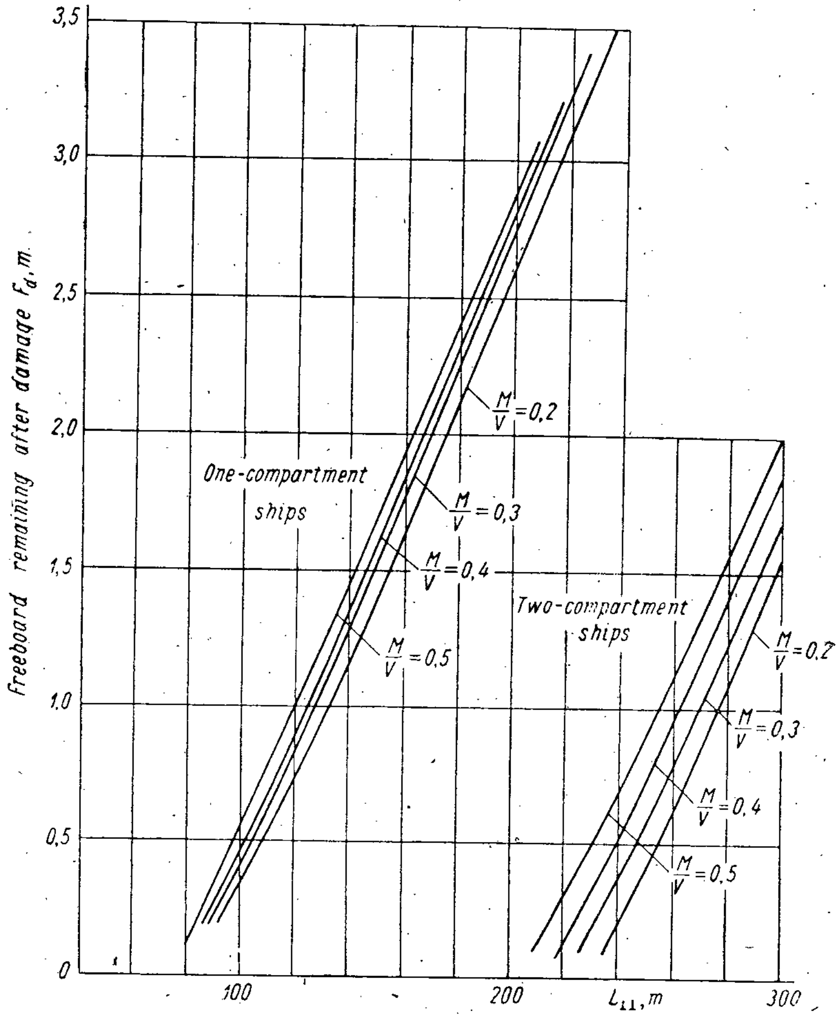

Fig. 6. Influence of ratio of machinery space volume to hull volume below margin line upon the freeboard remaining after damage.

Total number of passengers carried — 1000; thereof under bulkhead deck — 100; accommodation volume per a passenger — 20 m³; M — machinery space volume; V — hull volume below margin line.

tain types of high-capacity installations are of comparatively small dimensions.

In addition to the aforementioned factors it should be taken into consideration that modern high-speed ships are generally equipped with more perfect radiotelegraph aids of observation and have higher skilled crews which reduces the probability of collisions.

[1] As generally known when in collision, the ship which received a blow from that comming from the opposite direction, is damaged to more considerable degree.

In compliance with the above it appears necessary to decide if it is possible not to allow for machinery characteristics when determining the depth of the freeboard remaining after damage, bearing in mind the debatableness of this provision.

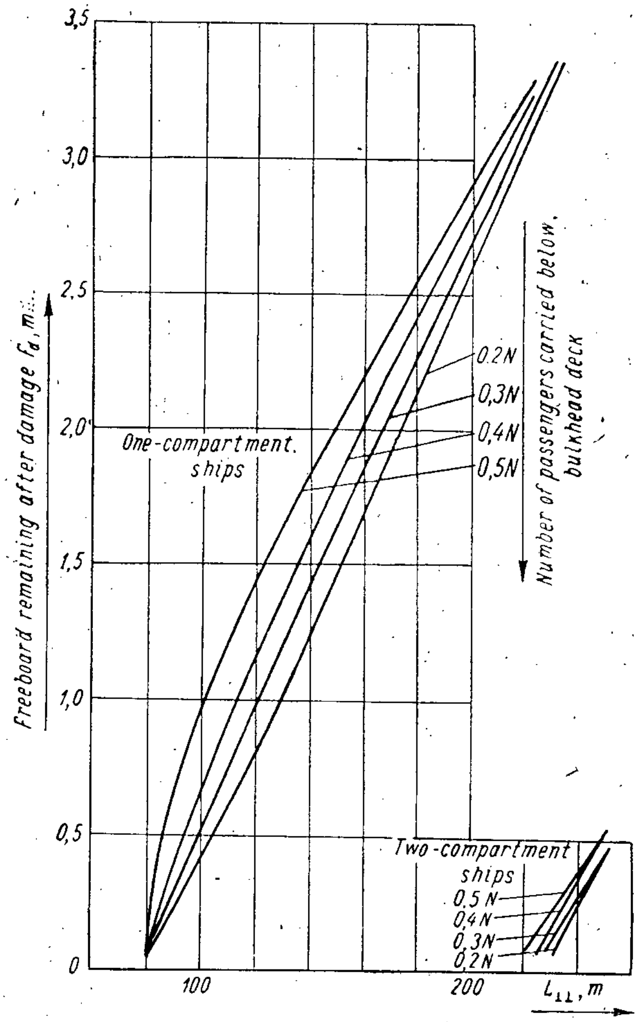

Fig. 7. Influence of a number of passengers carried below bulkhead deck upon the freeboard remaining after damage.

Number of passengers N — 1000; volume per a passenger — 20 m³; number of crew members — 500; machinery space volume is 0,4 of hull volume below margin line; per a crew member 7 m³; one — compartment ship; two — compartment ship; number of passengers carried below bulkhead deck.

In several cases the depth of the damaged ship freeboard, required by the 1960 Convention, is substantially influenced by ratio of the number of passengers carried above the bulkhead deck to the number of passengers carried below the bulkhead deck (Fig. 7). We have not succeeded in finding any logical explanation of assigning deeper residual freeboard to the ship on which the most part of passengers had been carried below the bulkhead deck [1]. For this reason it is considered possible in contrast to the present Convention, not to take into account the mentioned factor when assigning the depth of the damaged ship freeboard.

To our mind, the rest of the factors, the factor of subdivision depends on according to the provisions of the 1948 Convention,— that is the free-

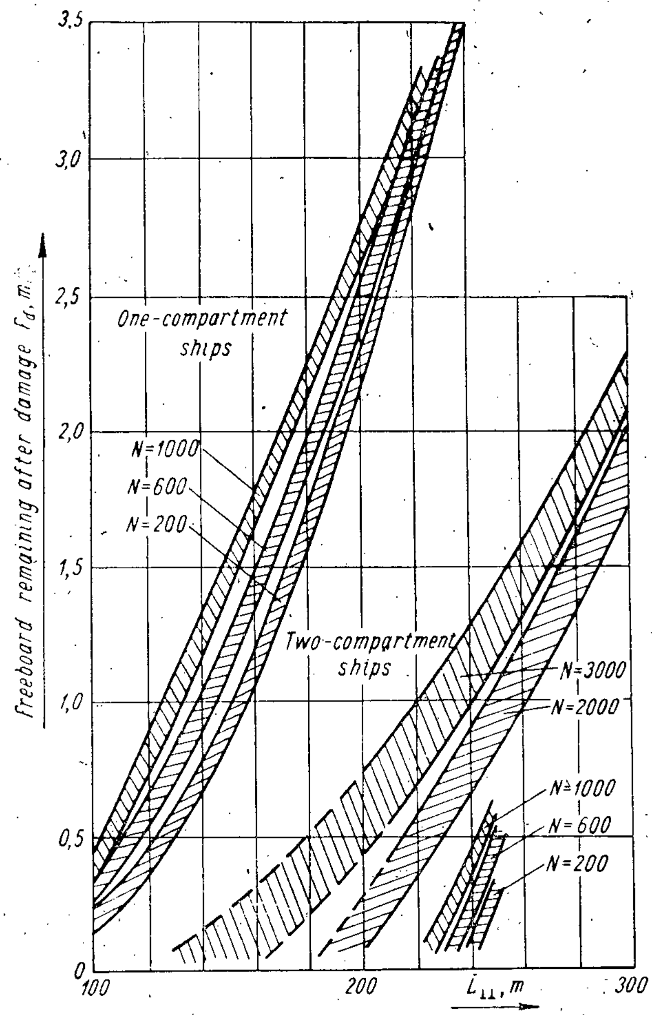

Fig. 8. Influence of number of passengers and other factors upon the freeboard remaining after damage.

Within hatched strips: ratio of machinery space volume — M to hull volume below margin line — V; changes from $\frac{M}{V}=0{,}2$ to $\frac{M}{V}=0{,}3$; accommodation volumes per a passenger changes from 20 m^3 to 30 m^3; number of crew changes from 0.25 N to 0.5 N; accommodation volume per a crew member — 7 m^3; one — compartment ship; two — compartment ship.

board remaining after damage, the volume per a passenger and the ratio between the number of passengers and the crew, may be dispensed with, as their influence is comparatively insignificant (Fig. 8).

[1] The time necessary for passengers, to get to the open decks and to the lifeboats depends not so much on passengers' location above and below the bulkhead beck, as on the arrangement of ladders, corridors and doors.

In view to the above it is proposed to consider the possibility of retaining, in the transition to direct assignment of the freeboard, only such factors as the ship's length and the number of persons on board, having eliminated the rest of the factors the 1960 Convention allows for.

However, apart from these factors, assigning the depth of the passenger ship's freeboard it is also necessary to take into consideration geometrical characteristics of the ship's shape which are automatically allowed for at present when calculating the floodable length. It seems quite reasonable to expect the similar relative buoyancy reserve for the ships which are equal in length and have the same number of passengers on board.

As the corresponding calculations show, in order to retain the constant ratio of buoyancy reserve and displacement, the residual freeboard should be changed in inverse proportion with the length to moulded depth ratio, ship length being constant. (1) and (2) represent the example of formulas determining the required depth of damaged freeboard.

By means of the following formula the residual freeboard of passenger ships which are to stand flooding of any one compartment can be correlated to the ship's length and number of passengers:

$$F_d = 13.5\,(L-40)\left(\frac{7N}{1000}+1\right)\frac{H}{L}+40. \qquad (1)$$

The minimum freeboard of passenger ships, which are to remain afloat with two adjacent compartments flooded, should be not less than that determined by formula (2):

$$F_d = 13.5\,(L-120)\left(\frac{2{,}3N}{1000}+1\right)\frac{H}{L}+120. \qquad (2)$$

In the above formulas:

F_a — residual freeboard, mm,

L — length between the perpendiculars, m,

H — moulded depth measured to bulkhead deck amidships, m,

N — number of passengers.

Structure of formulas (1) and (2) and value of their numerical coefficients are based on the following.

As it had been already mentioned, the minimum residual freeboard, remaining after damage, permissible due to considerations of compensation the errors which were possible while calculating the amount of water flowing into the hull was assigned equal to $\frac{1}{1000}$ of the ship's length. Such residual freeboard is to be provided for non-passenger ships — that is for cargo, fishing, whaling and similar ships having dimensions which will be recognized to be subject to the requirements of the present Convention concerning unsinkability.

The residual freeboard remaining after damage for passenger ships with minimum number of passengers on board should be also assigned equal to $\frac{1}{1000}$ of the ship's length, but with the carriage of larger number of passengers it appears rational to increase freeboard depth and, consequently, buoyancy reserve in damaged condition the latter determining the degree of damaged ship safety, as it was already mentioned.

In view to the above the degree of buoyancy reserve increase for ships in damaged condition, connected with the carriage of larger number of passengers, can be reduced for ships remaining afloat with two adjacent compartments flooded, since these ships, in contrast to those remaining afloat only with one of compartments flooded, will not be lost with a hole in way of main transverse watertight bulkhead, this fact by itself increasing the degree of their safety.

It seems rational not to require any additional increase of the residual freeboard depth as compared to the minimum permissible residual freeboard depth for passenger ships which in compliance with the requirements of the present Convention remain afloat with three adjacent compartments flooded, as executing of the above requirement provides sufficient degree of safety by itself.

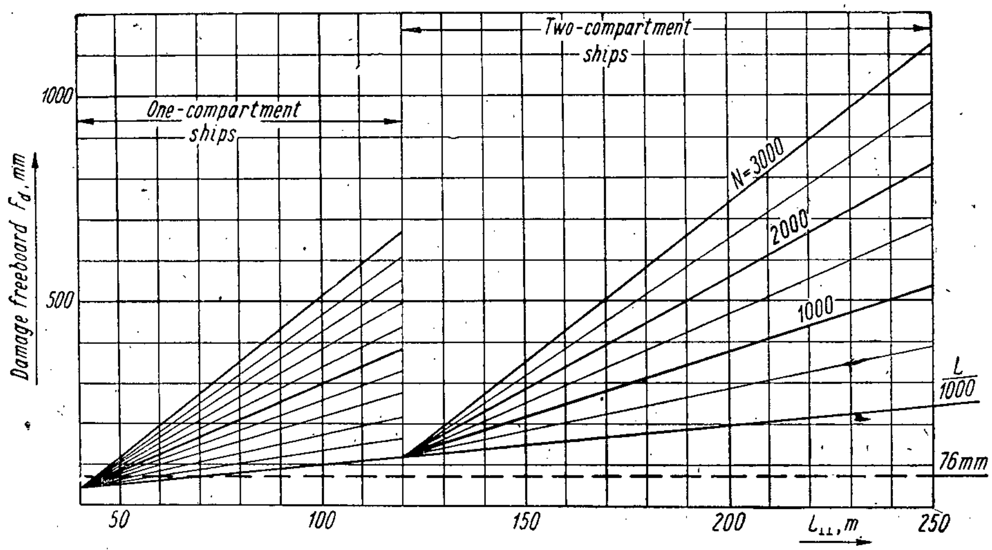

Fig. 9. Proposed dependence of freeboard remaining after damage upon the ship's length and number of passengers carried.

As a result of analysis of unsinkability of designed and built passenger ships it was established that unsinkability with one compartment flooded was technically attainable when:

— a compartment flooded starting with the length of 40 m;
— two adjacent compartments flooded starting with the length of 120 m;
— three adjacent compartments flooded starting with the length of 250 m.

Having further determined the depth of the residual freeboard assigned by the present Convention for a ship 120 m long, employed in the carriage of 500 passengers, and for a ship 250 m long, employed in the carriage of 2000 passengers, it appeared possible in compliance with fig. 9 to receive formulas (1) and (2), provided that the increase of the residual freeboard is directly proportional to the number of passengers carried.

While considering the advisability of proposed transition to direct rating of the freeboard remaining after damage it should be borne in mind, that the above method retains the possibility of plotting the permissible compartment lengths' curve representing certain conveniences for designers in solving the problem of transverse watertight bulkheads arrangement.

The 1960 Convention requirements are more strict as to the freeboard depth of the ships, carrying large number of passengers and employed in so called short voyages, the lifeboats of which do not permit to accommodate the whole number of passengers. Without detailed consideration of this question it should be indicated that the residual freeboard increase for a ship remaining afloat only with one compartment flooded is not to be considered as sufficient grounds for the whole of the passengers not to be provided with saving appliances because of the fact that the residual freeboard increase will not prevent such a ship from sinking with a hole in way of transverse bulkhead. Reducing of lifeboats in number may be allowed for the above-mentioned ships only under condition that these ships remain afloat with two adjacent compartments flooded.

For all this there is no necessity to make special increase of the residual freeboard of the ship in damaged condition.

It is not excluded that for ships similar to those mentioned above degree of unsinkability with 2 compartments flooded should be required beginning with smaller ships as compared with the ships navigating in restricted areas. But the absence of experience as to our country in building and operating of ships employed in short voyages prevents us from introducing any concrete motion concerning this problem.

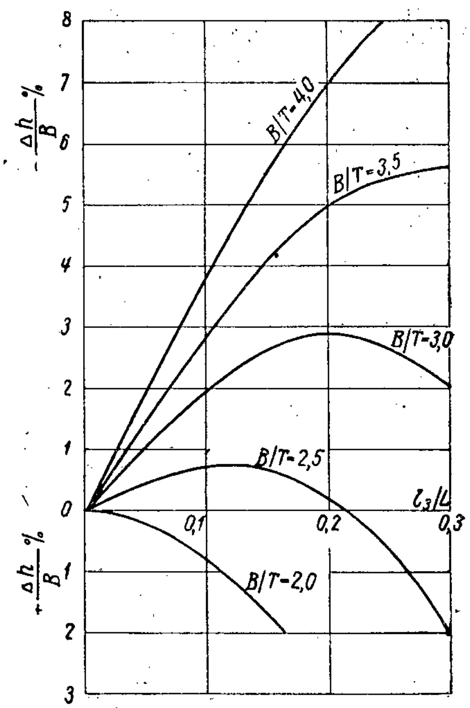

Fig. 10. Loss of initial metacentric height under symmetrical flooding of compartments of various length in ships with different ratios of breadth B to draught T, when the double bottom, the depth of which is 0.155 T is unflooded; block coefficient of the ship $\delta = 0{,}60$; Coefficient of permeability 1,0.

II. Concerning the assignment of stability in damaged condition

To eliminate the danger of a ship's capsizing when trying to equalize the heeling due to the negative stability the metacentric height in damaged condition should be positive till arrangements are made to upright the ship, as it is fixed in the 1960 Convention. Considering the errors possible in the calculation, in any case of loading and flooding the damage metacentric height (h_{dc}) is to be equal to five thousandth the ship breadth B.

$$h_{dc} = 0.005B.$$

It should be specified, however, as provided by the present Convention that in no case the metacentric height in damaged condition should be less than 0,05 m, since it is hardly possible to provide for greater accuracy in the determination of h_{dc}.

The above numerical values of the metacentric height in damaged condition should be obtained in the calculation of unsinkability by means of the permanent dispacement method.

Certain difficulties may occur in complying with the aforesaid requirement in the ships with the breadth to draught ratio $\frac{B}{T}$ upwards of 2.8 ÷ 2.9 (Fig. 10). As to the ships with smaller $\frac{B}{T}$ ratio, this requirement is complied with automatically even when the compartment of a permissible length is flooded, provided that the intact metacentric height in the worst loading condition from the stability point of view is approximately 0.02 B.[1]

In the ships with the large breadth to draught ratios compliance with the above requirement for the metacentric height in damaged condition is facilitated by the fact that in most cases such vessels are the passenger ships in which the requirement for a greater freeboard in damaged condition results in the smaller relative floodable length.

However, the requirement for h_{dc} =0.005 B and not less than 0.05 m, though undoubtedly necessary, is not, as it has been shown earlier (Fig. 2), sufficient.

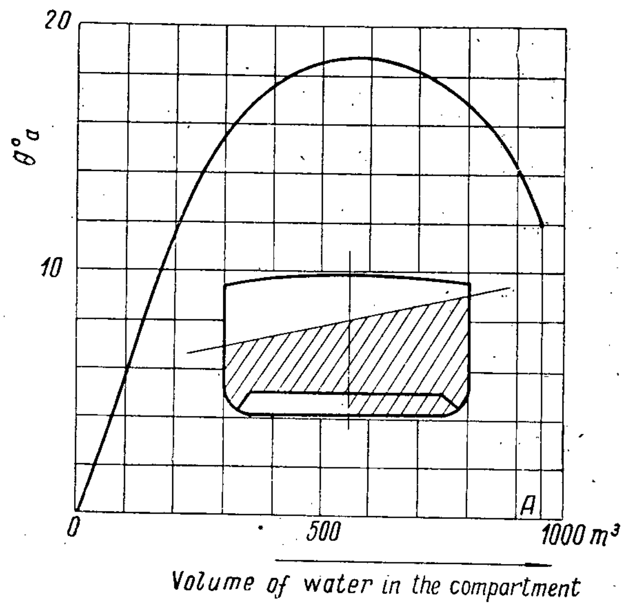

Fig. 11. Change of angle of list Θ° occured in the process of nonsymmetrical flooding of the compartment.

Characteristics of the ship: length $L_{\perp\perp}$ = 90,0 m, width B = 14,0 m; moulded depth H = 7,2 m.

It has been noted above that to ensure the damage control and save the persons on board a damaged ship, it is necessary to restrict the heeling angle in the final stage of unsymmetrical flooding till equalizing. In our opinion the rated heeling angle in the final stage of unsymmetrical flooding should not exceed 15° in the worst loading condition anticipated in service. In assigning this angle it has been taken into consideration that even the heeling angle equal to 12° turns to be the so called panick angle which, when exceeded, exerts a heavy psychological effect upon unprepared persons. When estimating the advisability of assigning a heeling angle of 15°, it should be borne in mind that in the intermediate stages of flooding the heeling angle can be 5—6° more (Fig. 11); in addition to that, the angle in question can increase by some 2—3° due to asymmetry of loading which is probable and permissible under the service conditions. Thus, having specified the rated heeling angle in unsymmetrical flooding to be 15°, we assume the actual heeling angles in the course of damage to be much more than those permissible.

The above requirements for the initial metacentric height of a ship in damaged condition and for the heeling angle in the final stage of flooding can be complied with even if the stability curves of a damaged ship are completely unacceptable (Fig. 2).

It is considered necessary, therefore, to regulate the stability curve characteristics of a damaged ship in the worst anticipated service condition of flooding and loading.

An analysis of the cargo ship's stability curves with a flooded compartment of a floodable length has shown (Fig. 12) that the worst

[1] As known, with the invariable floodable length the correction to the intact metacentric height rapidly increases with $\frac{B}{T}$ ratio; if $\frac{B}{T} \leqslant 2.2$ the metacentric height in damaged condition can even be greater than the intact metacentric height.

possible case is one of the damage occuring when the ship is nearing her destination, when intact metacentric height of a ship is minimum. For all this the double bottom was considered to be intact.

Apparently, the stability curve characteristics should be checked for this case in the first place.

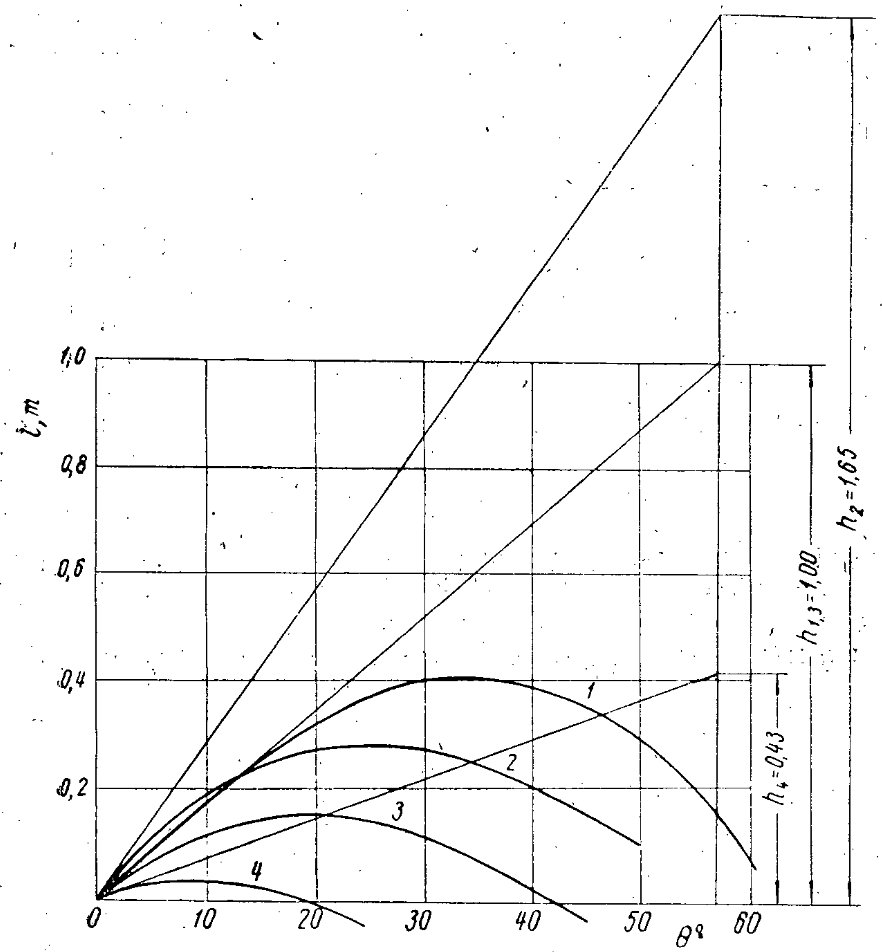

Fig. 12. Diagrams of stability of a dry cargo ship under different conditions of loading, when the compartment of floodable length has been flooded.

Characteristics of the ship; length $L_{\perp\perp}$ 120.0; ratio of width to draught $\frac{B}{T}=2,5$ ratio of moulded depth to draught $\frac{H}{T}=1,27$; block coefficient $\delta=0,70$; summarized length of superstructures is $l_s = 0,4\ L_{\perp\perp}$ *1* — undamaged ship in the beginning of voyage; *2* — the compartment is flooded, double bottom including, the ship is starting her voyage; *3* — the compartment is flooded above double bottom, the ship is at the beginning of her voyage; *4* — the compartment is flooded above the undamaged double bottom, the ship is nearing her destination.

For lack of necessary statistical material, it appears impossible at present to formulate sufficiently valid and practically feasible requirements as to static stability curves for ships in damaged condition. In view of the importance of its accumulation and due to the fact that these are the stability curves which determine the actual degree of damaged ship safety under the action of the heeling moments, it is proposed to introduce into the Convention a requirement with regard to submitting the stability curve of the newly built ships for consideration by Administration, to analyze the worst anticipated cases of flooding and loading.

The experience obtained enables to require the maximum lever of damage static stability not less than 0.1 m and a vanishing point of angle, the curve is broken at, due to water spreading over the ship, not less than 30° in case of symmetrical and 35° in case of unsymmetrical flooding of compartments.

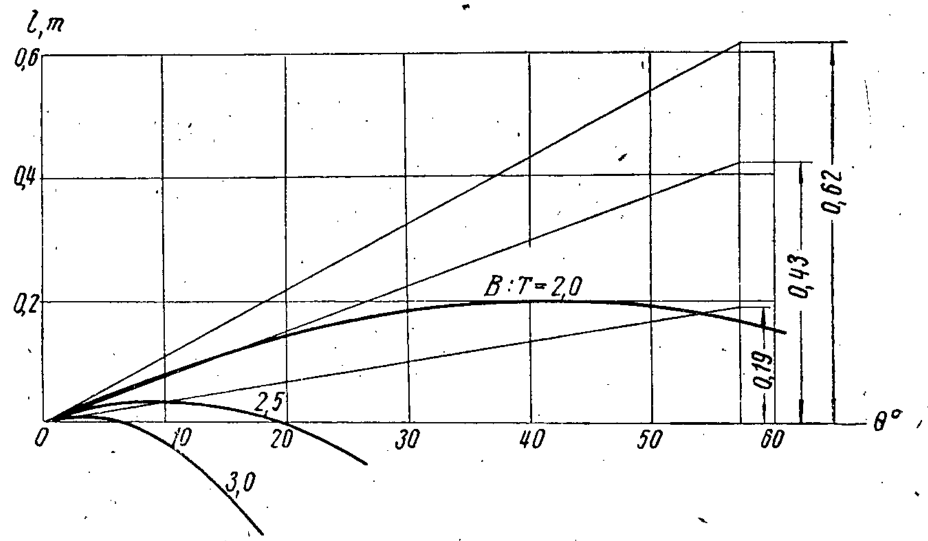

Fig. 13. The effect of ratio of breadth to draught upon the stability diagram when the compartment of floodable length is flooded.

Characteristics of the ship: length $L_{\perp\perp}$ 120 m; ratio of moulded depth to draught $\frac{H}{T}$=1,27; block coefficient δ = 0,70; summarized length of superstructures l_S =0,40 $L_{\perp\perp}$.

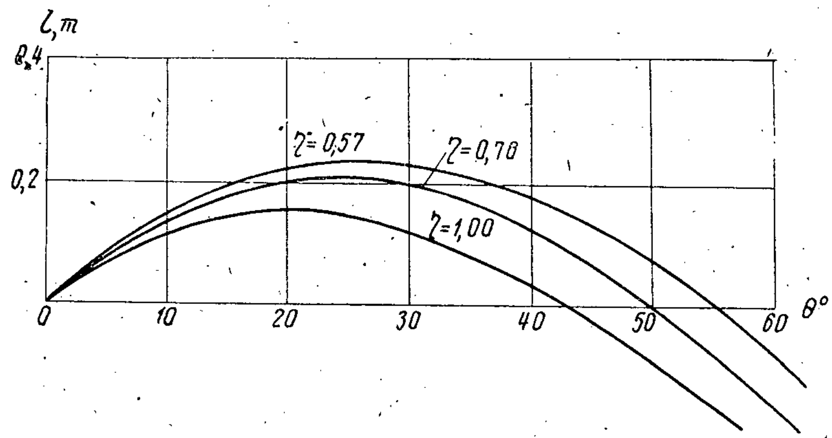

Fig. 14. Diagrams of stability when a compartment is flooded and under different factors of subdivision (double bottom is not flooded).

Characteristics of the ship: length $L_{\perp\perp}$ = 120 m; ratio of width of the ship to draught $\frac{B}{T}$= 2.5; ratio of moulded depth to draught $\frac{H}{T}$= 1,27; block coefficient δ = 0,70; summarized length of superstructures l_S=0,4 $L_{\perp\perp}$.

A possibility to comply with these requirements, though rather rigid for the ships with large breadth to draught ratios (Fig. 13), is confirmed by the data on the damage stability curve characteristics.

It should be noted that, while making no special requirements to the damage stability curve, the 1960 Convention automatically ensures greater degree of safety for ships with a lesser factor of subdivision at the expense of the reduction in the floodable compartment and, thus, increase in the freeboard remaining in damaged condition (Fig. 14).

A similar situation will remain as well in the proposed direct assignment of the freeboard depth remaining after damage subject to length, number of passengers and ratio of moulded depth up to bulkhead deck to intact ship length.

III. Concerning the Assumed Extent of Damage

In the practice of the assumed approach to the stability assignment the limiting of the longitudinal extent of damage excludes the possibility to comply with the requirements as to the number of flooded compartments to the expense of too close arrangement of the bulkheads.

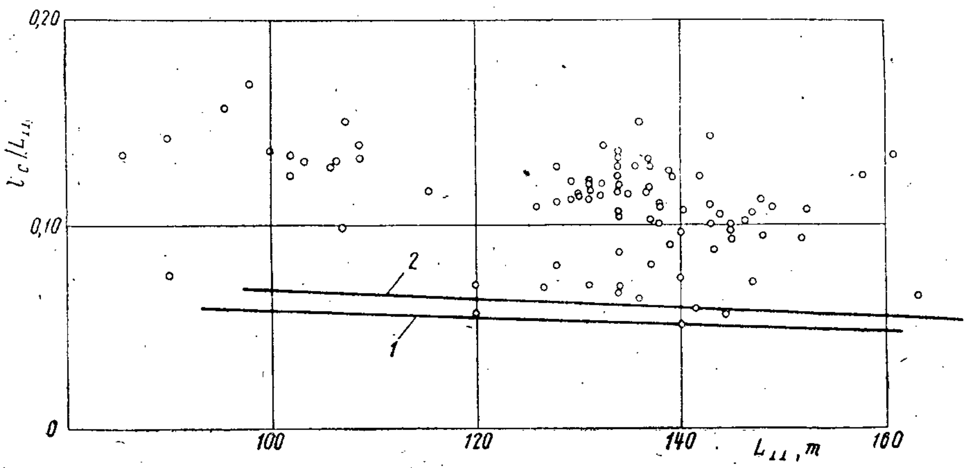

Fig. 15. Rated extent of the damage and actual lengths of the smallest compartments in ships constructed recently.

1 — relative extent of damage (according to the Convention 1948)

$$\frac{L_d}{L_{\perp\perp}} = \frac{0{,}03L_{\perp\perp} + 3{,}05}{L_{\perp\perp}};$$

2 — recommended relative extent of damage

$$\frac{L_d}{L_{\perp\perp}} = \frac{0{,}04L_{\perp\perp} + 3{,}05}{L_{\perp\perp}}.$$

Factor of subdivision η	Length of the compartment flooded	Freeboard after damage F_d	Maximum arm of stability l_{max}	Angle of vanishing point of stability
1.0	$0.263L_{\perp\perp}$	0.51	0.15	42
0.76	$0.200L_{\perp\perp}$	0.97	0.21	50
0.57	$0.150L_{\perp\perp}$	1.31	0.23	55

Increase in the longitudinal assumed extent of damage sometimes results in greater degree of ship's safety. Hence, proceeding from a reasonable intention to make the subdivision requirements more rigid without affecting other qualities of ships, it is advisable to fix in the revised Convention the longitudinal assumed extent of damage slightly greater than that given in the 1960 Convention.

An analysis of the statistical data on the actual minimum length of compartments (excluding the fore and after peaks) in the ships afloat (Fig. 15) shows that such an increase is quite possible.

It is advisable to assume the longitudinal rated extent of damage equal to 0.04 of the ship's length plus 3.05 m, omitting the limitation of maximum longitudinal extent of 10.67 m, as contained in the 1960 Convention.

It follows from Fig. 16, that the proposed increase in the maximum rated longitudinal extent of damage by 1 per cent of the ship length will not result in any alteration in the present practice of arranging the bulkheads.

The rated transverse extent of damage should be increased for passenger ships to a half of the ship's breadth; the damage in the design may have the shape of trapezium, as it was suggested, for example, in the USA proposals for modification of the 1948 Convention requirements.

The vertical extent of damage should be assumed from the base line to the bulkhead deck inclusive, as provided by the 1960 Convention.

ANALYSIS OF THE POSSIBILITY OF COMPLIANCE WITH ONE-COMPARTMENT STANDARD OF SUBDIVISION FOR DRY-CARGO SHIPS 90 m LONG

At the International Conference on Safety of Life at Sea in London, in 1960 the Soviet delegation proposed to apply one-compartment standard of subdivision to sea-going cargo ships over 90 m long.

As an additional grounding for the possibility of the realization of this proposal the calculations of ship's depth were made which were required to get the necessary value of residual freeboard after damage for ships 90 m long. Then the comparison was carried out between necessary depth and minimum one which allowed to determine what increase of moulded depth and, hence, what increase of metal expenditure and construction cost would take place in the case of the compliance with one-compartment standard of subdivision for ships 90 m long with different length of superstructures and machinery spaces as well as with different position of the latter along the ship's length.

It is also shown to what decrease in deadweight depending upon the increase of the hull weight the compliance with the subdivision requirements will lead for ships of this size.

I. Consistency of calculations and initial data for their fulfillment

Necessary moulded depth (according to the requirement for the minimum permissible freeboard remaining after a compartment flooded) was determined by the position of the damage waterline for a ship of 90 m long with some average ratios of main dimensions and average value of hull coefficients. When calculating the damage waterline position the displacement of an intact ship was assumed as unchanged, the depth being unlimited in height. After determining the position of a ship with one compartment flooded concerning the water surface the moulded depth appeared to be restricted by the required distance between the deck line and damage waterline in the case of normal sheer profile. Further, the hull weight corresponding to the rated moulded depth was determined as well as the weight alteration compared with that of corresponding to the minimum depth permitted by the Load Line Convention Rules. Then the change of the deadweight and construction cost was found.

The above mentioned calculations were performed for three different lengths of machinery space located in three positions along the ship's length.

The minimum freeboard permitted by the Load Line Rules which was taken into consideration for the rating of the minimum moulded depth was determined for several relative length of superstructure.

The calculations were made for a ship with four holds. The choice of this ship type was caused by the fact that nearly 60 per cent of ships 80—100 m long have four holds and more.[1]

In the calculations the value of main dimensions ratios and hull coefficients were assumed as average for existing cargo ships 90 m long:

— ratio of length L to width B $\frac{L}{B} = 7.0$;

— ratio of breadth B to draught T $\frac{B}{T} = 2.2$;

— block coefficient $\delta = 0.70$.

With the adopted $\frac{L}{B}$; $\frac{B}{T}$ and δ the given ship 90 m long has following characteristics:

displacement in fresh water $V = 4680\ m^3$,
length between perpendiculars $L_{\perp\perp} = 90$ m,
breadth $B = 12.8$ m,
draught $T = 5.8$ m.

According to the statistic data[2] the length of machinery space l_{ms} is equal to 0.12—0.20 of the ship's length for ships 80—100 m long.

Therefore, the calculations were made for ships 90 m long with relative length of machinery space $\frac{l_{ms}}{L}$ equal to 0.12, 0.16 and 0.20. Moreover there were considered the variants of the machinery space position between hold No 2 and hold No 3, between hold No 3 and hold No 4 and aft.

As a result of the examination of the existing designs of ships the forepeak length l_f was accepted equal to 0.07 L with the machinery space amidships, to 0.09 L with the machinery space between holds No 3 and 4 and to 0.11 L with the machinery space aft.[3]

The relative afterpeak length is actually the same for all ships and approximately equal to $\frac{l_a}{L} = 0.05$.

Therefore, in the calculations the afterpeak length was assumed as $l_a = 0.05$ L.

When rating the water volumes flowing into compartments the factors of permeability for some spaces were assumed as follows:
— for holds above the double bottom $\mu_h = 0.60$;
— for machinery spaces above the double bottom $\mu_m = 0.85$;
— for empty double bottom compartments $\mu_{db} = 0.98$;
— for double bottom diesel fuel compartments under the machinery space (with regard to the difference of the specific gravity of fuel and water which substitute fuel after damage) $\mu_{dbm} = 0.15$.

[1] It is obvious that the compliance with one compartment standard of subdivision for three hold ships 90 m long would accordingly require a more increase of the depth. However it is supposed to let the Administration the right to exempt some ships from subdivision requirements if their realization is impracticable. Therefore, the fact that it is difficult to comply with subdivision requirements of some part of ships 90 m long with two or three holds does not mean that all these ships must be exempted from the general requirements for those ships.

[2] "Schiffbautechnik", 1957, N 11, page 641.

[3] The increase of the forepeak length and consequently of the forepeak volume with the transfer of the machinery space from amidships aft may be explained by the necessity to take a greater amount of water in it with the purpose to get the adequate bow draught of a ship running in ballast.

Due to the calculation the average factors of permeability for all holds (except hold No 1) with empty compartments under them were taken equal to 0.63; a factor of permeability for hold No 1 was taken equal to 0.64 due to the constant increase of double bottom height in this compartment. The average factor of permeability for the machinery space together with double bottom fuel compartments under it was taken equal to 0.80.

In the case of the machinery space amidships the lengths of all four holds were taken equal while in cases of machinery spaces aft and between holds No 3 and No 4 these lengths varied when it improved the damage position. Such cases happened with $\frac{l_{ms}}{L} = 0.12$ when it was reasonable to prolong the midship hold and accordingly to diminish the length of most unfavourably situated hold in relation to the damage trim.

When determining the hull weight augmentation caused by the increase of moulded depth it was supposed that the weight changed in proportion to square root of moulded depth.

A rule of hull weight dependence upon the moulded depth was taken as a result of analysis of existing diagrams and formulae for the determination of the hull weight, the reserve being provided in way of weight increase. In particular, well known Raben diagrams specify a less increase of the hull weight.

The dependence of construction cost of the ship 90 m long upon the moulded depth was determined by calculations in which the data of the actual cost of the steel hull, machinery equipment and some auxiliary works were used in the construction of 7 ships of different sizes.

II. Calculation results and their analysis

In accordance with the calculation results the diagrams which permit to estimate the alteration of deadweight and construction cost of the ship 90 m long with the definite location and length of machinery space along the ship's length as well as with definite relative superstructure length were plotted.

The diagram (Fig. 1) shows what should be the ratio of moulded depth H to draught T in four hold ships 90 m long in order that the residual freeboard remaining after flooding of one of the compartments should be equal to one thousandth of the ship's length (90 mm).[1]

The diagram (Fig. 2) indicates the minimum admissible ratio of moulded depth H to draught T permitted by the Load Line Rules for the ship 90 m long with different total superstructure length l_s.

The diagram (Fig. 3) reproduces the approximate dependence of the deadweight loss upon the change of ratio $\frac{H}{T}$ which is caused by the moulded depth increase. The diagram (Fig. 4) shows the dependence of the construction cost increase of the ship 90 m long upon the change of ratio $\frac{H}{T}$ which is caused by the moulded depth increase.

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[1] At the Conference in London the USSR delegation proposed to assign the minimum freeboard remaining after damage according to ship's dimensions since the compliance with a normal requirement to have a freeboard of 3″ after damage makes the relative buoyancy reserve of large ships lower and this contradicts to the basic principle which appeals for greater safety for large ships. As in this case the value $\frac{L}{1000}$ comes near to 3″, the conclusions obtained below might apply to ships which have a damage freeboard of 3″.

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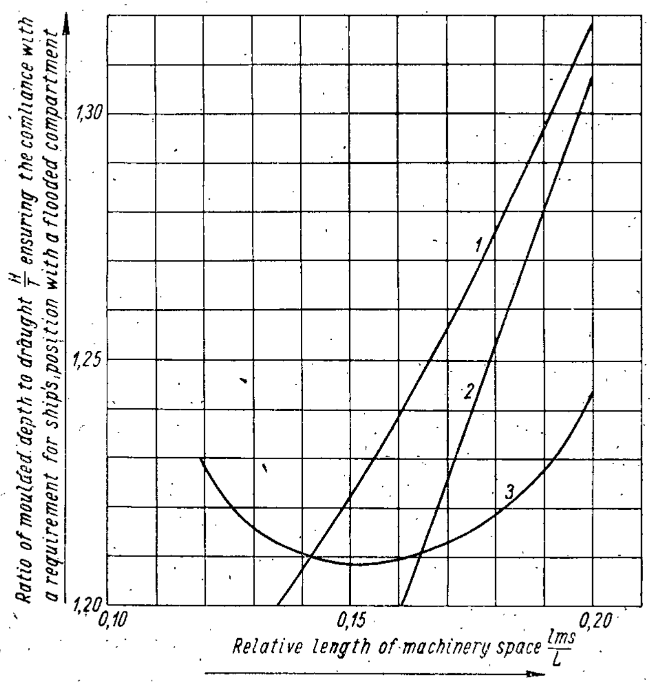

Fig. 1. Ratio of moulded depth to draught of the four hold ship 90 m long necessary to ensure the required freeboard remaining after one compartment flooded.

1 — machinery space between hold No 2 and hold No 3; *2* — machinery space aft; *3* — machinery space between hold No 3 and hold No 4.

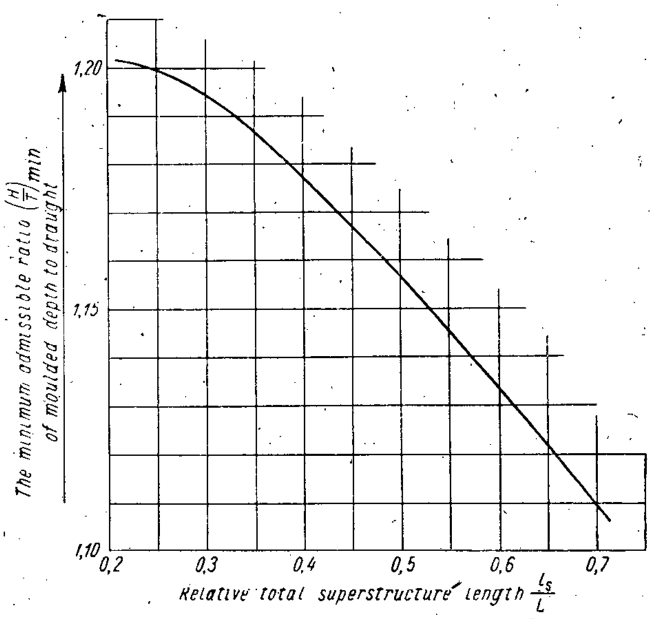

Fig. 2. The minimum admissible ratio of moulded depth to draught permitted by the Load Line Rules for the ship 90 m long with the different total superstructure length.

Comparing the ratio $\left(\frac{H}{T}\right)_{min}$ (Fig. 2) required by the Load Line Rules and the ratio $\left(\frac{H}{T}\right)$ demanded by the subdivision requirements (Fig. 1) we can find the ratio $\left(\frac{H}{T}\right):\left(\frac{H}{T}\right)_{min}$ according to which and with the help of fig. 3 and fig. 4 the deadweight loss and construction cost increase may be determined.

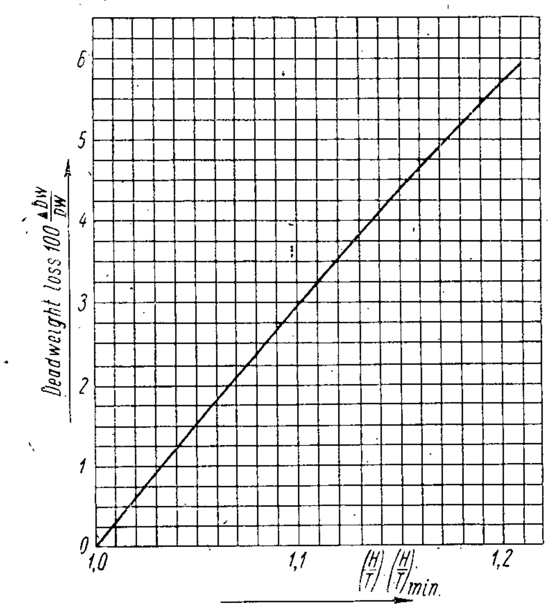

Fig. 3. Dependence of deadweight loss of the ship 90 m long upon the change of the ratio $\frac{H}{T}$ caused by the moulded depth increase.

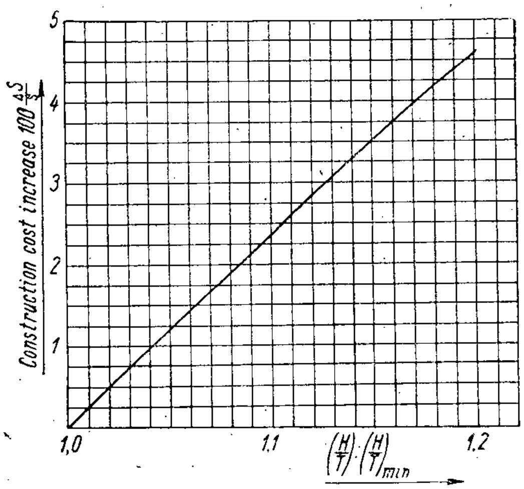

Fig. 4. Dependence of construction cost increase of the ship 90 *m* long upon the change of the ratio $\frac{H}{T}$ caused by the moulded depth increase.

For example, with the relative length of machinery space amidships equal, to $\frac{l_{ms}}{L}=0.15$ due to subdivision requirements the ratio $\frac{H}{T}$ should be not less than 1.21.

Simultaneously according to the Load Line Rules in cases of the total superstructure length not exceeding 0.4 of the ship's length the ratio $\left(\frac{H}{T}\right)_{min}$ may be equal to 1.176.

Provided that $\left(\frac{H}{T}\right):\left(\frac{H}{T}\right)_{min}=\frac{1.21}{1.176}=1.03$ the construction cost increase would approach 0.7 per cent while the deadweight loss — 0.9 per cent.

In cases of relative lengths of superstructures and machinery spaces most frequently encountered in ships 90 m long as well as in cases of the most unfavourable location of intermediate machinery spaces for the damage position, the construction cost increase due to the compliance with subdivision requirements with the increase of moulded depth will not exceed 1 ÷ 1.5 per cent, while the deadweight will be reduced by the same percentage.

Considering that the moulded depth increase entails some extension of volumes of holds which allows the more complete use of their cargo carrying capacity when transporting cargoes of high specific loading capacity, the compliance with subdivision requirements for four hold ships 90 m long is justified from the economical point of view taking into account the reduction of ships lost in damages.

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CONCERNING THE UNIFICATION OF THE ESTIMATION OF INTACT STABILITY

It is proposed to unify the rated variants of ship load conditions and to work out the uniform rules on stability estimations with the purpose of mutual comparison of the results of stability estimations in different countries.

I. Various load conditions

The stability of passenger ships shall be calculated for the following load conditions:

1. The ship in full load with full stores and full number of class and unberthed passengers with their luggage.
2. The ship in full load and full number of class and unberthed passengers with their luggage, but with 10% of stores.
3. The ship without cargo, but with full stores and full number of class and unberthed passengers with their luggage.
4. The ship as in the point 3 but with 10% of stores.

The stability of dry cargo ships shall be checked at the following service conditions:

1. The ship in full load with draft prescribed by Load Line Convention and homogeneous cargo filling cargo holds, tweendecks, trunks and spaces of cargo hatches and casings, with full stores and fuel, but without liquid ballast;
2. The ship as in the point 1, but with 10% of stores and fuel;
3. The ship in full load with draft prescribed by Load Line Convention and homogeneous light cargo (if carriage in specially foreseen) filling cargo holds, tweendecks, trunks and spaces of cargo hatches and casings, and also stowed on the upper continuous deck, with full fuel and stores.
4. The ship as in the point 3, but with 10% of fuel and stores.
5. The ship without cargo, with 10% of fuel and stores.

The stability of ships carrying timber shall be checked in the following conditions of loading:

1. The ship with timber cargo (with stow volume foreseen) in holds and on deck with full fuel and stores at the draft prescribed by the Load Line Convention.
2. The ship as in the point 1, but with 10% of fuel and stores.
3. The ship with timber cargo (with the greatest stow volume foreseen) in holds and on decks with full fuel and stores.
4. The ship as in the point 3, but with 10% of fuel and stores.
5. The ship without cargo with 10% fuel and stores.

The stability of ships carrying in bulk liquid cargo, shall be checked under the following conditions of loading.

The ship in full load with full fuel and stores at the draft in accordance with Load Line Convention.

The ship in full load, but with 10% of fuel and stores.

The stability of fishing vessels shall be checked under following load conditions:

1. Going out for fishing with full fuel and stores.
2. Coming back from fishing with full catch in hold and on deck and with 10% of fuel and stores.
3. Coming back from fishing with 20% of catch in holds or on deck, with 70% of normal stores of ice and salt and 10% of fuel and stores.

Under conditions of service as in the points 2 and 3 for vessels fishing with nets the weight of wet nets on deck shall be included into computations of stability.

4. The ship on fishing with detailed data of loading condition corresponding to service experience in different countries.

II. Stability diagrams

1. Statical and dynamical stability diagrams shall be constructed by means of one of the methods generally adopted in the ship theory, taking into consideration the influence of free surfaces of liquid cargoes. The drawing scale of the hull shall be such that the breadth of the ship shall be not less than 250 mm.

When building the hull the thickness of deck planking may be taken into account.

2. When calculating the righting arms of form the superstructures, which are considered as closed by the Load Line Convention (Rules XLI, XLII, XLIII and XLIV), may be taken into account. In computation of stability the actual length and height of superstructures shall be accepted.

If superstructures do not comply with the requirements of the rule XLI (d) of the Load Line Convention, i. e. where the doors in the superstructure bulkheads leading to the continuous deck are the only way out to the deck and where the upper coaming edge of the superstructure doors submerges at a heel less than 60°, the height of the superstructures in the calculation of stability is assumed one half of its actual height. If the upper coaming edge of the doors in such superstructures submerges at a heel equal or exceeding 60°, the superstructure can be regarded as closed and its height in the calculation of stability is assumed equal to the actual one.

3. When calculating the righting arms of form, deck houses on the upper deck can also be taken into consideration, provided:

a) the Administration is convinced that the deck houses have been built in accordance with the Construction Rules for sea-going vessels;

b) they have watertight doors, the strength of which satisfies the requirements of the 1-st class closure;

c) they have a supplementary exit to the upper deck.

When all the above enumerated conditions have been fulfilled, the actual height of deck houses may be included in the computation.

If the strength of the deck houses complies with the Construction Rules recognized by Administration, and the arrangement of the outer doors corresponds to the 1-st class closure but there is no exit to the upper deck, such deck houses, when calculating the righting arms of form, are not taken into consideration at all, but the openings in the deck inside such deck houses shall be considered closed, whether they have closures or not.

Deck houses without 1-st class closures and deck houses the strength of which does not meet the requirements of the Construction Rules are not taken into consideration when calculating the righting arms of form. The openings in the deck inside such deck houses and the companion hatches are considered closed, if their coamings and arrangements for closing satisfy Rules XVIII and XXI of the Load Line Convention.

Separate companions of entrances into underdeck spaces are not taken into account when calculating the righting arms of form.

The openings in the metal decks under wooden companions are considered as open.

Deck houses on the superstructure decks or on the deck houses decks are not taken into account when calculating the righting arms of form, but the openings inside such deck houses are considered as closed.

4. At the inclination of a ship the beginning of submerging of openings in sides, decks and superstructures which are considered unclosed, should be characterized on the diagram of statical stability by a step in stability curve and in further computations the flooded compartments are considered nonexistent; or if the ship is sinking due to her being flooded through openings, the curve cuts short at the corresponding angle of inclination (angle of flooding) and the ship is considered to have entirely lost her stability.

When calculating the righting arms of form it is recommended to determine the angle of inclination corresponding to the commencement of flooding through the openings and to construct the curve of the angle flooding as a function of ship displacement.

Any openings in the upper decks or in the sides of the hull as well as in decks, sides and bulkheads of superstructures are considered unclosed if the closing arrangements do not comply with the Rules X—XVI, XIX, XX, XXVI, XXVIII, XLIII—XLV of the Load Line Convention.

The small openings such as openings for passing wires and ropes of special installations, tackles and deep-water anchors as well as holes of scupper, discharge or sanitary pipes, which in fact have no influence on the stability at the dynamical heeling, are not to be considered as open, and the angle of inclination corresponding to their submerging is not to be considered as the angle of flooding.

When computing the righting arms of form at large angles of heeling for timber carrying ships it is allowed to take into account the deck cargo with its rated height equal to .75 of actual height, but not exceeding the deck of superstructure of the first tier.

5. To tanks taken into consideration when determining the influence of liquids on the stability at the big angles of heel should be referred the tanks for each kind of liquid (including those for water ballast), in which, according to conditions of service, can simultaneously be free surfaces.

In view of the above it is recommended to work out one rated combination of single tanks or combinations of tanks for each kind of liquid cargo.

Of all combinations of tanks for every kind of liquid possible in practice or of single tanks those, which create the greatest value of the total summary heeling moment ΔM_{30} at the angle of heel equal to 30° due to flowing of liquids should be chosen.

The correction is in all cases calculated for the tank filled for 50% of its capacity.

It is recommended to calculate the value of ΔM_{30} for every single tank from the formula:

$$\Delta M_{30} = vb\gamma \sqrt{\delta}\, \overline{l}$$

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where

v — the tank total capacity, m^3,

b — the tank maximum breadth, m,

γ — the specific weight of liquid in the tank, t/m^3,

$\delta = \frac{v}{abc}$ — the tank block coefficient,

a — the tank maximum height, m,

c — the tank maximum length, m,

$\bar{l}$ — dimensionless coefficient, to be determined from the table according to the ratio b/a.

Table

Values of the dimensionless coefficient $\bar{l}$ for the computation of influence of liquids on stability at heavy heeling

b/a	20	10	5	2	1	0.5	0.2	0.1
$\bar{l}$	0.111	0.113	0.114	0.094	0.049	0.024	0.010	0.00

Intermediate values are determined by interpolation (linear or graphic).

The tanks, which satisfy the following condition may not be included into computation

$$vb\gamma\sqrt{\delta}\,\bar{l} < 0.01D_{min},$$

where:

D_{min} — the minimum ship displacement for the cases of loading mentioned above.

The usual remainder of liquids in the empty tanks is not taken into account in computations.

PRINCIPLES OF DRAWING UP THE INFORMATION ON STABILITY

In service conditions the ship stability essentially depends on a load distribution, presence of liquid free surfaces in tanks, watertightness of openings and other factors available at the ship master's disposal. Therefore, the responsibility for stability rests with the ship's master.

To bear this responsibility, the master should have at his disposal information on stability of the ship which has been submitted to the Administration's approval and calculated on the basis of the inclining tests and standards of stability and containing the following data:

1) The general characteristics of the ship stability, practical directions, allowing for ship particulars, and recommendations which the ship crew might follow in ship operation, viz:

a) a loading schedule made so that the ship stability does not drop below the limit fixed in the standards;
b) directions as to restricting the ship's sailing by a certain region or season of the year, weather conditions or state of sea, limit points of wind force and intensity of sea involving special precautions in ship steering;
c) recommendations as to restricting the manoeuvring conditions, viz. limitation of speed in turning, avoiding the resonance conditions in rolling danger of going in a following sea at a speed close to the wave speed etc;
d) service recommendations such as the ballast trimming, i. e. liquid ballast in particular, watching the low-lying open type scuttles, prevention of icing, shutting the doors and other holes in deck and superstructures, limitation of the deck cargo height on timber carrying vessels and so on.

2. The data showing the ship stability in typical cases of loading; use of such data enables the crew to estimate the ship stability under the loading conditions most frequently met with in practice without making any calculations.

3. Typical diagrams, auxiliary tables and charts, service forms and instructions, enabling the crew to make, without assistance, the stability calculations under non-typical conditions of loading; as far as possible, these diagrams should be most simple handy for use.

4. The limit values of the metacentric height permitted by the stability standards for any draught or displacement of the ship, enabling the crew to make, without assistance, the stability calculations and to establish whether the rated stability sufficient. Instead of the metacentric height the information can present the limit values of the ship centre of gravity height above the keel or the weight static moment in height.

5. Various additional material and reference data assisting the crew to draw the more complete and accurate consequences of the ship stability.

It is recommended to use special instruments and devices enabling the crew to make, without assistance, the stability calculations under non-typical conditions of loading.

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REGISTER OF SHIPPING OF THE USSR

C

STANDARDS OF STRENGTH
FOR SEA-GOING STEEL VESSELS

Publishing House "Morskoj Transport"
Leningrad 1961

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РЕГИСТР СОЮЗА ССР

НОРМЫ ПРОЧНОСТИ МОРСКИХ СТАЛЬНЫХ СУДОВ

(Утверждены приказом по Министерству морского флота № 46 от 20 февраля 1958 г.)

Издательство «Морской транспорт»
Ленинград 1961

REGISTER OF SHIPPING OF THE USSR

STANDARDS OF STRENGTH
FOR SEA-GOING STEEL VESSELS

(Approved by the Order of the Ministry of Marine of the USSR, No. 46, February 20, 1958).

LENINGRAD 1961

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Standards of strength for sea-going steel vessels are issued in addition to the Rules for Construction and Classification of sea-going steel vessels, issued by the Register of the USSR. The Standards prescribe checking the strength of ship's hull and its structural members under possible loading on the basis of permissible stresses which are accepted as a part of the yield point of the steel used. General strength of the ship is checked also on the basis of comparing the maximum moments acting on the ship in a seaway with the maximum moment the hull is capable to withstand, when the stress in the most distant edges of the ship's weakest section attains the yield point (limiting moment). Special standards are given for the comparison of maximum moments estimated with dynamical forces taken into account, with the limiting ones.

The Standards of strength are intended for application in the work of the design offices, research and educational institutes and organizations of the Register of the USSR.

This English edition of the Standards of strength for sea-going steel vessels is a complete translation of the corresponding Russian edition published in 1958 with only minor corrections inserted.

PREFACE

Standards of strength for sea-going steel vessels are worked out for the designing of merchant vessels by calculation method as well as for checking up the strength of vessels now afloat.

The calculation method permits the designing of ships with the most efficient hull structures on the basis of modern achievements of science and engineering. Designing of hull according to the Rules for classification and construction of sea-going steel ships restricts the design offices to the use of such structures only, which were adopted in previous practice.

The Standards of strength and calculation method acquire especial significance in connection with the use of high-tensile (low alloy) steels.

The Standards of permissible stresses are established on the basis of experience gained in designing of ships, in shipbuilding, in navigation of ships as well as on the basis of results obtained from full scale static and sea tests of some ships.

The Standards of strength for sea-going steel vessels come into force on February 20, 1958.

The present Standards have been constituted by the Register of the USSR in co-operation with Central Scientific Maritime Research Institute and Academician Kryloff Institute on the basis of:

a) drafts "Provisional Standards of strength for sea-going steel ships" and "Methods of Strength calculation for sea-going dry-cargo ships" worked out by Central Scientific Maritime Research Institute in 1953—1957 using research works carried out previously and generalized experience in navigation of merchant ships;

b) draft "Provisional Rules for making calculations of strength of sea-going steel ship hull structures" worked out by Academician Kryloff Institute in 1956—1957 on the ground of results of research works;

c) recommendations of interdepartmental conference on use of the low alloy steel in merchant shipbuilding, called in November 1954 by Academy of Science of the USSR and the Society of Shipbuilders.

The draft "the Standards of strength for sea-going steel vessels" has been considered and approved by a Commission under Academician Shimansky's chairmanship set up according to decision of the Ministries of Marine, Shipbuilding Industry and Higher Education. The representatives of the Register of the USSR, Central Scientific Maritime Research Institute, Academician Kryloff Institute, Leningrad Shipbuilding Institute and Central Design Office No. 1 of Ministry of Marine took part in the work of the commission.

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Comments on the draft "the Standards of Strength" presented by some design offices have been taken into account in the final text of the Standards.

All remarks and suggestions aimed at improving the Standards of Strength for sea-going steel ships are requested to be forwarded to the Head Office of Register of the USSR so that they could be taken into consideration in subsequent issues of the Standards.

In the present Standards the following abbreviations are accepted;

Head Office of Register of the USSR — Register;

Rules for Classification and Construction of sea-going steel vessels— Rules;

Standards of Strength for sea-going steel vessels — Standards.

CHAPTER I

GENERAL PROVISIONS AND STANDARDS

§ 1. GENERAL PROVISIONS

101. The Standards are intended for calculating the strength of hull structures of sea-going steel merchant ships.

Application of the Standards to sea-going steel ships is compulsory when designing by calculation method ships of 60 m and over in length.

When designing according to the Rules for Classification and Construction of sea-going steel vessels, issued by the Register of the USSR, the calculation shall be made in compliance with requirements of the present Standards for:

1) Sea-going ships over 110 m in length;
2) Ships over 140 m in length navigating in restricted areas.

If the values of stress obtained by calculation exceed the permissible, the structure shall be reinforced.

102. The scope of calculations submitted in the technical design shall conform with the following enumeration:

1. Summary table of the weights of hull and dead weight distributed into twenty theoretical compartments with a short explanatory note about methods of drawing-up this table.
2. Instructions on ship loading prepared in compliance with item 407 for cargo and cargo-passenger ships, whale factories and similar vessels (may be submitted later simultaneously with detailed drawings).
3. Determination of bending moments and shearing forces in accordance with § 4 of the Standards, with data on the possible deviations of loading from that recommended in compliance with the item 402, with provisions elucidating fulfilment of requirements of the items 403 and 404 and with bending moment curves (item 402).
4. Determination of the moment of inertia and modulus of the ship main sections in pursuance of § 5 of the Standards.
5. Checking of general strength of the hull in compliance with § 6 of the Standards.
6. Calculations of local strength of the hull in compliance with Chapter III of the Standards.
7. Calculation of hull reinforcement with due regard for inertia forces of concentrated cargoes in stowage positions when heavy cargoes are transported (see items 1401 and 1103).
8. Determination according to the Rules scantlings of the structural members, which for low alloy steel may be recalculated on the principle of equal strength according to § 16 of the Standards.
9. Detailed provisions in accordance with § 3 of the Standards on prescribing norms not specified in the present Standards.
10. Determination of hull deflection (see item 610) is compulsory for vessels with the ratio of length to depth exceeding 15; but with a view to give more precise definition to norms in subsequent issue of the Standards, the deflection of the ship is recommended to be determined for all ships and particularly for those being built of high-tensile steel.

103. Simultaneously with detailed drawings, the following calculations shall be made and submitted to the District Office of Register of the USSR, supervising the construction:

1. Strength calculation when launching a ship (see § 13).
2. Strength calculation when docking a ship (see § 13).

104. The following materials shall be submitted at the request of the Register:

a) in technical design:

1. Calculations of strength of the ship and her structural members determined in accordance with requirements of the Rules and comparison with those defined according to the Standards as well as the table of hull structure amidship according to the Rules.
2. Calculation of strength of the ship's structures (masts, deck houses, machinery foundations, etc.) under the action of inertia forces in seaway (see § 14);

b) when presenting the detailed drawings:

1. Checking of the ship's hull for general vibration of the first tone (in relation to the resonance).
2. Checking of the vibration in the after part of hull structure (in relation to the resonance).
3. Calculation of the local vibration in the vicinity of engine room when poor balanced engines are installed.
4. Checking of the local strength of the after end of hull structure for effect of vibrating loading caused by revolution of the propellers.

105. Scantlings of the structural members which were not computed after the Standards shall be determined according to the Rules taking into account the relevant provisions of the Standards.

106. Main bulkheads of the hull shall be arranged in compliance with the Rules.

107. Strength calculations of hull's structural elements forwarded to the Register shall be made for checking of the finally accepted scantlings and material.

108. General strength of ship is considered to be ensured if the normal and shear stresses caused by the longitudinal bend as well as summary normal stresses do not exceed the values of permissible stresses fixed by the table I and the ratioes of the limiting internal moment to the design bending statical moment $\left(\frac{M_{\text{lim}}}{M_{\text{st}}}\right)$ and to the summary moments $\left(\frac{M_{\text{lim}}}{M_{\text{st}}+M_{\text{dyn}}}\right)$ is equal to or in excess of the values specified in the same table.

109. Local strength of hull structure is considered to be ensured if the normal and shear stresses in the structures considered do not exceed permissible stresses given in table I.

110. In addition to checking of the structural members on the basis of their stresses it is necessary whenever required by the present Standards or conditions of the structural member service to check the whole structural member and its elements for buckling.

It is necessary for full utilisation of the hull material under the action of rated and maximum loading to aim at ensuring stability of the hull's main carrying structures, increasing whenever possible the Eiler's stresses of all said structures up to the yield point of the material (see items 604, 605).

111. Besides the above said checking of strength of the hull's structural members on the basis of their stresses, limiting moments and buckling it is necessary in accordance with the present Standards to check: strength when the ship is being launched or docked; hull's vibration; strength of the ship's forward end for impact of sea waves (see § 13, 14 and 16; continuation § 1 see page 12).

§ 2. DESIGN LOADING AND STANDARDS OF PERMISSIBLE STRESSES

Table 1

No.	Structural members and characteristics of rated stresses	Design loading	Permissible stresses in fractions of the steel yield point value (in numerator—for dry cargo ships, in denominator for tankers)	Notes
		General strength		
1	Hull's longitudinal girders and plating taking part in general bend. Stresses caused by general bend	Bending moment M_{st} when the ship floats in the wave, disregarding the dynamical component (see items 402—404)	For ships with length $L \leqslant 100$ m: $\frac{.50}{.45}$ For ships with length $L \geqslant 200$ m: $\frac{.60}{.55}$	1. For intermediate lengths of ships the Standards shall be obtained by linear interpolation. 2. The ratio of the limiting moment to the bending one when the ship floats in the wave shall be: $\frac{M_{lim}}{M_{st}} \geqslant 1.7$ for dry cargo ships; $\frac{M_{lim}}{M_{st}} \geqslant 1.8$ for tankers (see also item 603). 3. The ratio of the limiting moment to the bending one estimated with due regard for the dymanical component (see item 406) shall be $\frac{M_{lim}}{M_{st}+M_{dyn}} \geqslant 1.35$ for dry cargo ships $\frac{M_{lim}}{M_{st}+M_{dyn}} \geqslant 1.45$ for tankers
2	Hull's structural members taking part in general bend and subject to effect of local loads	Bending moment M_{st} when the ship floats in the wave disregarding the dynamical component (see items 401 404). Local load-pressure head (see item 608)		
	a) structures of bottom, sides and decks between main bulkheads. Summary stresses caused by general bending of the hull and by the bend of the structure itself $(\sigma_1+\sigma_2)$		$\frac{.60}{.05}$	Summary stresses in inner bottom plating in the supporting sections at bulkheads are not limited in ships framed transversally and may be somewhat increased on approval of the Register in case of longitudinal framing

No.	Structural members and characteristics of rated stresses	Design loading	Permissible stresses in fractions of the steel yield point value (in numerator—for dry cargo ships, in denominator for tankers)	Notes
	b) summary stresses in the free edge of the longitudinal caused by general bend of the hull, bend of the structure between bulkheads and bend of longitudinals between supporting frames ($\sigma_1 + \sigma_2 + \sigma_3$)		$\frac{.90}{.80}$	
	c) plating in case of transverse framing. Summary stresses at the middle of the long side of supporting contour, caused by general bend of the hull, of the structure between bulkheads and of the plating between the frames		$\frac{1.00}{.80}$	As to determining of the stresses caused by bend of plates see item 706
	d) plating in case of longitudinal framing. Summary stresses at the middle of the short side of supporting contour, caused by general bend of the hull, of the structure between bulkheads of the longitudinals between the frames and of the plating itself ($\sigma_1 + \sigma_2 + \sigma_3 + \sigma_4$)		$\frac{1.00}{.80}$	
3	Hull's structural members affected by shearing force at the general bend of the hull	Shearing force when the ship floats in the wave N_{st}	$\frac{.30}{.30}$	Double margin of stability in regard to shear stresses shall be ensured for side plating

II. Local strength

				Standards of local strength apply to transverse framing, longitudinal framing and plating on assumption that they are affected only by the local load
4	Shell plating, stresses at supporting sections of plates	Static loading uniformly distributed on the plate (see § 8)	$\frac{.80}{—}$	

No.	Structural members and characteristics of rated stresses	Design loading	Permissible stresses in fractions of the steel yield point value (in numerator—for dry cargo ships, in denominator for tankers)	Notes
5	Floors	Static loading, uniformly distributed on the bottom (see § 9)	—	
	a) stresses in face bars	With cargo in hold	.60 / —	
		With no cargo in hold	.90 / .50	For dry cargo ships this case is considered if the ship may navgate with some empty holds
	b) shear stress in webs		.35 ÷ .50 / .25	For design loading indicated above (line 5a)
6	Double-bottom framing and plating	Loading caused by cargo (see item 906)		
	a) stresses in supporting sections of plates		.80 / —	
	b) stresses in free edges of longitudinals		.60 / —	
	c) stresses in span section of plates and in free edges of longitudinals	Loading under test head (see item 906)	.80 / —	
7	Bottom and side framing in the forward end of ship	Hydrodynamical pressure in case of impact of the sea wave (see item 1603)	.90 / .90	
8	Side framing	Loading uniformly distributed on horizontal structural members and trapezoidal or triangular loading on vertical ones (see § 10)	.80 / .50	
	Hold frames	Loading up to load waterline	.50 / —	Additional checking
9	Framing of decks, superstructure decks and platforms web beams, beams and carlings	Statical uniform loading (see § 11)	.60 / —	
	Deck framing of tankers	Oil pressure when the ship is listed (see item 1104)		
	a) stresses in face bars	—	— / .50	

No.	Structural members and characteristics of rated stresses	Design loading	Permissible stresses in fractions of the steel yield point value (in numerator—for dry cargo ships, in denominator for tankers)	Notes
	b) shear stresses in webs	—	— / .25	
	Deck framing of dry cargo ships	Loading with due rygard for inertia forces caused by rolling of the ship when carrying heavy cargoes (see item 1401)	.70 / —	
	Decks (platforms) of fresh and ballast water tanks, stresses in framing and supporting sections of plates	Loading — head of water column from plating-up to air tube-top, but not less than 2,5 m above the tank top	.80 / —	
10	Bulkheads	Horizontal ties		
	a) watertight bulkheads, stresses in framing and span sections of plates	Uniform loading under water head equal to the distance fom the bulkhead deck down to the level of the structural member	.80 / —	
		Vertical stiffeners		
		Trapezoidal or triangular loading (see item 1201)	.80 / —	
	b) bulkheads of ballast and fresh water tanks Stresses in framing and in span sections of plates	Vertical stiffeners Trapezoidal loading Horizontal structural members and plates—uniform loading (see item 1202)	.60 ÷ .80 / —	In case of alternate loading on both sides, the stresses in plates on supports shall be not more than .80 σ_m
	c) oil-tight bulkheads	Vertical stiffeners trapezoidal loading Horisontal structural members and plates — uniform loading (see item 1203)		
	1) Stresses in framing		— / .55	
	2) Stresses in supporting sections of plates		— / .90	
11	A. Bulkheads (external) of the first tier superstructures and deckhouses	Statical uniform loading under the assumed water head h_{dh} (see item 1205)		1) When the draft $d \geqslant .8\,D$ the loading h_{dh} shall be increased by 10 per cent and when the draft $d \leqslant .7\,D$, the load may be decreased by 10 per cent

No.	Structural members and characteristics of rated stresses	Design loading	Permissible stresses in fractions of the steel yield point value (in numerator—for dry cargo ships, in denominator for tankers)	Notes
	a) stresses in framing		$\frac{.80}{.80}$	2) Design loading (pressure heads) for superstructure and deckhouse bulkheads of the ships of restricted area of navigation may be decreased in proportion to the ratio of wave height in this restricted area to that accepted for the ship in accordance with requirements of item 403
	b) stresses in supporting sections of plates	For front bulkheads $h_{dh} = .07\ L + 1$ For side bulkheads $h_{dh} = \frac{1}{2}\ (.07\ L + 1)$ For after bulkheads $h_{dh} = \frac{1}{4}\ (.07\ L + 1)$ L — the length of ship on the summer load line in metres	$\frac{1.0}{1.0}$	
	B. Bulkheads (external) of the second tier superstructures and deckhouses	Pressure head upon the bulkheads is accordingly half the value of that upon the first tier bulkheads		
	a) stresses in framing		$\frac{.80}{.80}$	
	b) stresses in supporting sections of plates		$\frac{1.00}{1.00}$	
12	Girders of hull framing	Forces acting upon the ship when being docked or launched (see § 13)	$\frac{.60}{.60}$	Stability against bulckling of structura member shall be ensured with the margin coefficient 1.5
	a) stresses: 1) caused by general bend 2) local		$\frac{.80}{.80}$	
	b) shear stresses 1) caused by general bend		$\frac{.35}{.35}$	
	2) local		$\frac{.45}{.45}$	
13	Masts, deckhouses machinery foundations when affected by inertia forces caused by rolling of the ship	Inertia forces in a seaway (see item 1401)		When checking masts and deckhouses the wind pressure is accepted equal to .2 ton/m²
	a) stresses at structural members		$\frac{.70}{.70}$	
	b) shear stresses in structural members		$\frac{.40}{.40}$	

112. The structural members and plating thicknesses obtained in accordance with the Standards will be accepted for the building, but depending on special service conditions of the ship, kind of cargoes carried and on corrisiveness and protection of the high-tensile steel, if it is used, the Register may require reinforcing of certain hull's structural members.

113. Deviations from the present Standards for the purpose of rising efficiency and improving service characteristics of ships may be allowed within ±10 per cent, on condition of preliminary approval by the Register on the basis of more exact calculation methods, confirmed by the theory of ship strength or by tests.

114. Standards of permissible stresses for the whole hull and its structural members are set in table 1 of § 2 and in the chapters II and III of present Standards on the basis of margins of strength accepted, taking into account the concrete service conditions and importance of each structural member considered.

115. General provisions and indications for prescribing Standards of Strength are given in § 3 and shall be used if no concrete indications are given in table 1 and chapters II and III.

201. Calculation of the general and local strength of ships to be built shall confirm that the stresses produced in the hull structural members do not exceed permissible values fixed at the table 1.

The standards of permissible stresses are effective when the design loading is accepted and provisions specified in the chapters II and III are fulfilled.

References to paragraphs and items specifying the loading and instructions for calculations are given in the table.

The standards for tankers apply also to whale factories and similar vessels.

In all cases when special instructions are not available the permissible shear stresses shall be accepted equal to .57 of the normal stresses which are allowed for the same structural members.

In the column 4 of table 1 unless otherwise stated, the standards are given for the normal stresses.

§ 3. GENERAL PROVISIONS AND INSTRUCTIONS FOR ASSIGNING THE STRENGTH STANDARDS

301. General.

1. Strength calculation of a structure shall ensure for it the required margin of its strength, i. e. when external forces are increased up to the assumed margin of strength the stresses in the structure will not exceed the dangerous limits in case of which the structural member can collapse or be deformed.

2. In accordance with the provisions of point 1, strength calculation shall be generally subdivided as follows:

a) determination of values and character of external loading acting upon the structural member under calculation;

b) prescribing of proper margin of strength for the structural member under calculation and determination of the maximum forces;

c) determination of the maximum stresses in sections of structural members on the basis of assumed external loading increased in accordance with the prescribed margin of strength;

d) prescribing of the standards for dangerous stresses and checking of strength conditions.

3. If in calculation of a structural member the superposition principle, i. e. proportionality between the external forces and internal stresses, may

be accepted, the margin of strength established for the structural member may be included into calculation not by increasing the external loading as outlined in the point above but by establishing standards for permissible stresses which are assumed as certain portions of dangerous stresses.

The strength calculation in this case shall be subdivided as follows:

a) determination of values and character of design loading;

b) determination of the maximum stresses in the sections of structural member on the basis of assumed design loading;

c) prescribing of the standards for dangerous stresses;

d) establishment of proper margin of strength and standards for permissible stresses as well as checking of the strength conditions.

4. The parts of calculation specified in the points 2 and 3 are of equal importance as to their influence upon the degree of accuracy and trustworthiness of the calculation results. Therefore as regards both the necessary bases and the accuracy of calculations, these parts of calculation shall answer in equal measure the purposes set for the whole calculation.

5. In case of need, besides chesking of the structural member strength on the basis of the stresses, it is necessary to check the stability against buckling of the whole structure and its elements, to check the maximum strains (deflections and deflection angles) and to check the vibration in connection with determination frequencies of the own oscillations and amplitudes of the forced oscillations of the structure.

6. The calculations shall be opened up to exhaustive checking of all data enclosed therein and shall have references to the sources.

302. Determination of the value and character of design loading.

1. External design loading acting upon the ship's hull and its structural members shall be determined in accordance with methods established by present Standards taking into account the technical requirements to designing of the ship.

2. External loading as to its character of change are subdivided into the following categories:

a) invariable loading which does not change its value during the whole time of acting;

b) statically variable loading which changes its value during the whole time of acting and the period is several times that of own oscillations of the structure considered; the possible maximum limits of its amplitude with due regard for the sign shall be established for this load;

c) dynamically variable loading which has the period near or less than that of own oscillations of the structure considered; the law of variation shall be determined for this structure with the purpose of subsequent estimation of the dynamical coefficient in regard to the structure considered. The acting loading multiplied by the dynamical coefficient obtained for the relevant structure shall be accepted as design loading; in this case the design loading is considered as static.

The impact loading is a particular case of the dynamically variable loading.

For such loading the time of acting shall be determined with the purpose of subsequent definition of the dynamical coefficient in regard to the structure considered; the impact loading multiplied by dynamical coefficient is accepted for calculation and considered as static.

3. Each of the external loading specified in the point 2 as to the character of its action shall be subdivided into the following categories:

a) permanent loading — acting constantly or during considerable stretch of time, as, for example: water acting upon ship's bottom with the head to the load waterline in smooth water, weight of cargoes, weight of the structure itself, loading upon the hull when the ship is in smooth water, pressure of water, fuel oil or oil on the bulkheads of tanks etc.

b) occasional loading — acting only in certain cases, for example: the loading in case of tightness tests, local loading upon the hull when the ship is docked, loading upon the masts and deckhouses caused by wind pressure in case of hurricane, loading upon the bulkheads and decks in case of ship's damage, forces acting upon the whole hull and its structural members when the ship navigates under the most unfavourable conditions which are accepted as design, including the loading on the deck caused by water coming over it in sea-way, forces in foundations, reinforcements under deckhouses, which originate under extraordinarily severe weather conditions. etc.

4. When calculating the structure subjected to occasional loading it is necessary to assess the degrees of probability of their action.

5. When different loadings of the above said categories act upon the structure simultaneously it is necessary to estimate the maximum values of the both — the loading permanently acting upon the structure and the occasional loading, assessing the degrees of probability of the latter.

303. Determination of the maximum stresses in sections of hull structural members.

1. The stresses obtained by calculation depending on character of their distribution shall be referred to one of the following categories:

a) general stresses — overspreading at considerable part of volume or section area of the hull's structural member, and which can cause damage or inadmissible strain of the whole structural member if they exceed the value of the dangerous stress;

b) local stresses — overspreading only at a small part of volume or section area of the hull's structural member, and which if they exceed the value of the dangerous stress can cause only local strains not followed by damage or inadmissible general strains of the structure.

2. If the structural member which is to be calculated is affected simultaneously by several systems of external loadings, the stresses determined for each of the loading taken separately shall be summed according to rules of theory of the strength of ship in order to obtain in such a way the design stresses; in this case of all possible combinations of the external loading only such shall be accepted which ensure the maximum values of design stresses.

3. The normal or shear stresses: shall be accepted as design stresses depending on the strength theory which is assumed as a basis for strength calculation in compliance with usual practice for the hull's structures considered.

When new calculation schemes are being used the shear strength theory is recommended to follow.

4. When determining stresses in the sections of a structure the influence of possible buckling in certain components of the structural member shall be taken into account by means of including into calculation the reduction coefficients each time when this phenomenon occurs.

If the influence on the values of design stresses of the reduction coefficients included into calculation is considerable (over 10 per cent), the strength of the structure shall be calculated in compliance with the orders given in the items 301—302, i. e. when determining stresses the external loading is assumed to be increased in accordance with the margin of strength accepted for calculation.

Note. Conformably to calculation of general longitudinal strength, the hull is checked in regard to the limiting moments instead of increasing the design bending moments in accordance with the margin of strength accepted for calculations (see table I and § 6).

304. Assigning of the Standards for dangerous stresses.

1. Dangerous stresses (σ_0, τ_0) when the values of loading does not vary. are:

a) for normal and principal stresses — yield point of material ($\sigma_0 = \sigma_y$);

b) for shear stresses —.57 of the yield point of material ($\tau_0 = .57\sigma_y$);

c) for shear stresses in welded seams — the yield point of weld metal, determined by methods of the Governmental Standard of the USSR 6996—54 (ГОСТ), but not more than the yield point (σ_y) of the main metal;

d) for shear stresses in welds — 57 per cent of the yield point of weld metal;

e) for shear stresses in rivets — limit of elastic sliding of the rivet (τ_r) which is established depending on type of riveted joint (influence of calking is to be considered);

f) for tensile stresses in rivets — yield point of rivet material;

g) for shear stresses in rivets when simultaneously affected by the tensile stresses — the stresses are to be determined from the formula

$$\tau'_r = \tau_r \left(1 - \frac{\sigma}{\sigma_y}\right),$$

where

τ_r — the limit of elastic sliding of the rivet;

σ_y — the yield point of rivet material;

σ — the active tensile stress;

h) for shear stresses in rivets — 50 per cent of ultimate shear strength of the rivet ($.50\tau_{r,s}$).

2. For variable and alternating stresses the fatigue limit of the structure material or that of the joint is accepted as dangerous stress (when the number of stress alternation cycles is limited — the temporary fatigue point may be accepted, but not exceeding the yield point of material).

For certain structural members the fatigue point is established in consideration of presence of welded and riveted joints, character of loading variation in time is being taken into account.

For general stresses caused by bend of the hull floating in a wave, the fatigue point of material when determining the dangerous stress shall not be taken into consideration on account of limited number of stress alternation cycles.

For stresses specified in the point 1 but of a restricted local character, the standards for dangerous stresses may be raised without prejudice to the structure strength; in this case dangerous condition of the structure shall be judged by indication of allowance of such maximum strains which can take place when the local stresses exceed the limits established for general stresses.

Note. Raising of dangerous stresses to the same extent shall not be permitted for local stresses changing their value and sign on account of possible originating of local cracks in material (due to its fatigue) and their consequent propagation to adjacent parts of the structure.

4. For general normal and shear stresses which can cause buckling of the structure, the dangerous stress shall be accepted as ultimate stress determined as Eiler's stress taking into account the correction for change of elasticity modulus (see item 604 and diagram of the fig. 9).

305. Assigning of the strength margins and standards for permissible stresses.

1. The permissible stresses shall be assigned as a certain part of the dangerous stresses stipulated by the required margin of strength included into calculation.

2. When assigning the margin of strength the degree of trustworthi-

ness and accuracy of the calculation as well as the conditions the structure under consideration encounters with in construction and in service.

In accordance with the above said provisions the following principal circumstances shall be taken into consideration:

a) accuracy of determining of the external forces acting upon the structure;

b) degree of accuracy of the calculation formulae accepted;

c) confidence in mechanical qualities of the structure material and in carefulness of the fabrication;

d) influence on the structure's strength of the technology of construction connected with the changes in mechanical properties of material, with the constructive strains and with the reactive stresses;

e) experience gained in construction and service of structures similar to that designed;

f) service term of the structure;

g) consequences which may be caused by disturbance of integrity of the structure or its portion.

CHAPTER II

CALCULATION OF GENERAL LONGITUDINAL STRENGTH OF HULL

§ 4. DETERMINATION OF DESIGN BENDING MOMENTS AND SHEARING FORCES

401. General longitudinal strength of hull when it is being calculated on the basis of permissible stresses shall be checked by the bending moments and shearing forces obtained when the ship is statically poised on the wave (M_{st}, N_{st}).

402. The bending moments and shearing forces shall be estimated for the most unfavourable cases of those specified in loading plan of the ship The variants of loading being subject to consideration (for selection of the design values of bending moments) shall include the following:

a) ship fully loaded with full stores;

b) ship fully loaded with 10 per cent of stores;

c) ship in ballast with the most unfavourable distribution of ballast and stores;

d) other variants of loading (see item 407) if higher stresses are expected to be produced hereby (caused by general and local bends).

To take account of the deviations in distribution of cargo from that recommended by the loading plan the value of M_{st} corresponding to the above mentioned variants shall be increased for all dry-cargo, oil-carrying, whale factory and similar ships fully loaded. For dry-cargo ship the said value is increased by redisposition of a part of cargo from midship holds into end holds (in case of design hogging moment) or vice versa — from end holds into midship holds (in case of design sagging moment) without any change in the gravity centre position along the ship's length; the weight of cargo redisposed shall be 20 per cent of that being embarked in the end holds when the cargo weight is distributed in proportion to the volumes of the holds.

It is supposed hereby that number of the holds does not exceed that given in the chapter 9 of the Rules.

In ships having less than four cargo holds the redisposition of cargo is supposed to be such that in sagging condition 20 per cent of cargo in the fore and aft parts of the ship, which is at first distributed in proportion to hold volumes shall be transfered to the midship part of cargo spaces.

It is presumed that fore and aft parts of ship each correspond to 25 per cent of the cargo holds' summary length.

For oil-carrying ships, whale factories and similar vessels the deviations from the recommended stowage shall be taken into account through increasing bending moment in smooth water by 10 per cent.

403. The statical bending moments and shearing forces are calculated by means of putting the ship statically on the crest and trough of the trochoidal wave which has the following dimensions:

a) length accepted as equal to the length of ship on the summer load line

$$\lambda = L; \qquad (1)$$

b) height accepted as equal to

$$\left.\begin{aligned} h &= \frac{\lambda}{30} + 2 \text{ —for ships of less than 120 m in length;} \\ h &= \frac{\lambda}{20} \text{ —for ships of 120 m and upwards in length.} \end{aligned}\right\} \qquad (2)$$

For ships navigating in restricted regions dimensions of the wave shall be taken from statistic data available for the given region. If the maximum length of the wave is less than the length of ship it shall be assumed to be equal to the length of the ship, the height of the wave being accepted from the statistic data; the maximum wave may be assumed as a value not more than that indicated above for the ships of unrestricted navigation. The bending moments and shearing forces may be calculated by a more precise method with due regard for the oblique course of ship in relation to waves.

404. At the determination of bending moments and shearing forces it is necessary:

a) to calculate separately the smooth water bending moment and additional moment imposed by the passage of the wave

$$M_{st} = M_{sw} + M_{rw}.$$

b) the plotting of curves of ship's weights, buoyancy forces and deadweight as well as the subsequent calculation thereon of the bending moments and shearing forces shall be carried out on 21 equidistant ordinates by usual tabular method, the distribution of loading for each compartment between two adjacent sections is being considered as uniform.

The weight and volume of fore and aft parts of the ship extending outside the theoretical compartments (end ordinates) shall be taken into account completely as regards the value and moment (the moments of weight and volume of the ship's ends being left invariable) in relation to those obtained by exact calculation.

c) the discrepancy of bending moment from zero at the 21th ordinate is allowed only not more than 5 per cent of the maximum value of the bending moment. Otherwise the ordinates shall be corrected and calculation repeated.

d) when the crest of the wave is risen above the upper deck, the forces of buoyancy shall be taken into account completely if a superstructure extending to the ship's sides is arranged in this region, but if there is a bulwark, the forces of buoyancy shall be taken into account for the height of the bulwark; when there is no bulwark or the wave crest is risen above the bulwark, the influence of this crest (or its part extending above the bulwark) shall be taken into account not completely but 50 per cent of that part of the wave height.

405. Amidships, for a distance of 5 per cent of length forward and aft of the section at which the maximum bending moment is acting, the design bending moment shall be accepted to be equal to the maximum.

For sections of the ship outside the above said span of 10 per cent of the ship's length the design bending moments shall be determined as follows: for each section the design bending moment is that, which corresponds to the ordinate disposed on the diagram nearer to the maximum ordinate at the distance equal to 5 per cent length of the ship.

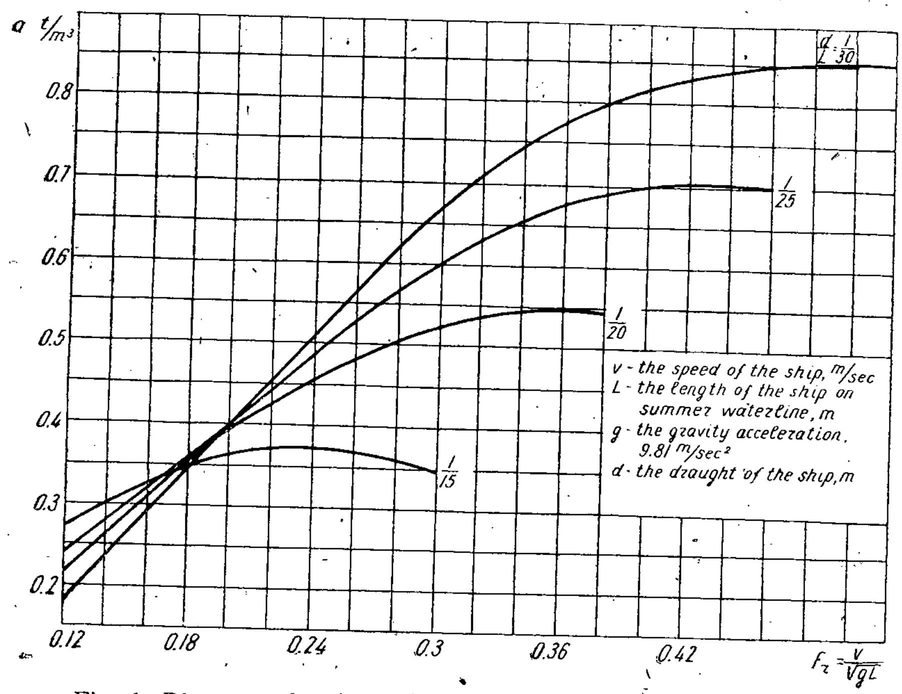

Fig. 1. Diagram of values of the coefficient a in the formula (3).

406. The design values of dynamical components M_d of the bending moments for checking the general strength of hull by means of the

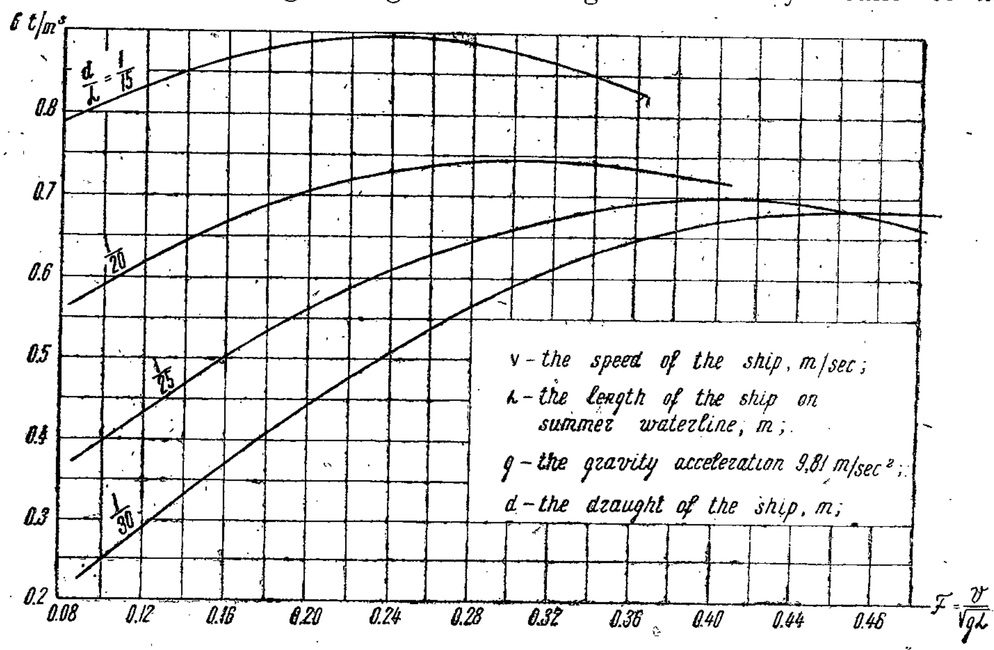

Fig. 2. Diagram of values of the coefficient b in the formula (3).

limiting moments shall be determined for such a speed of the ship in rough sea, at which under conditions of unrestricted navigation the values of these components become maximum. This speed may be assumed to be by 4 knots less than the maximum design speed.

The dynamical component of bending moment at midship section for each variant of loading when the ship is in sagging position shall be determined from the formula

$$M_d^{wt} = -0{,}2\,[a + b\,(\delta - 0{,}6)]\,B^2 L\,\frac{h_r}{\bar{\lambda}_r}, \qquad (3)$$

where M_d^{wt} — the value of dynamical component of bending moment in — sagging position in tm;

a and b — the coefficients determined on the diagrams given in fig. 1 and 2;

δ — the block coefficient of hull;

B — the hull breadth on the waterline in metres;

$\bar{\lambda}_r$ — the relative length of resonance wave determined in the diagram given in fig. 3;

h_r — the height of design resonance wave in metres determined from the expressions

$$h_r = \frac{\bar{\lambda}_r L}{20} \text{ when } \bar{\lambda}_r L > 120\text{ m}; \qquad (4)$$

$$h_r = \frac{\bar{\lambda}_r L}{30} + 2 \text{ when } 60\text{ m} \leqslant \bar{\lambda}_r L \leqslant 120\text{ m}$$

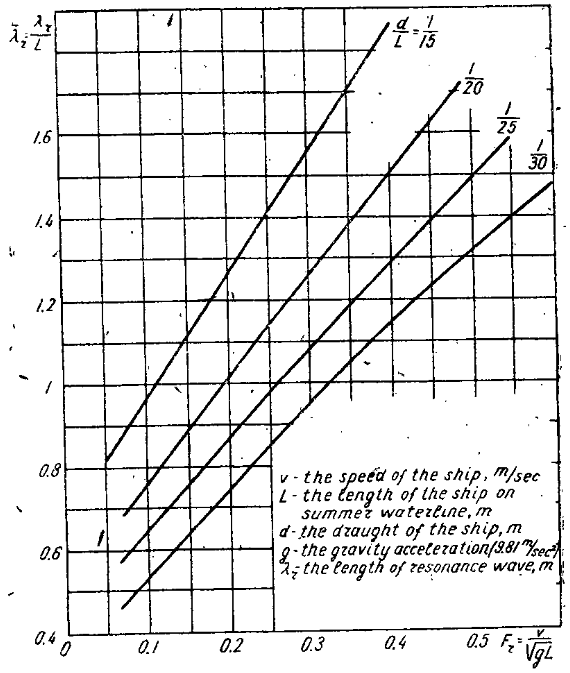

Fig. 3. Diagram for determining the length of resonance wave.

The value of dynamical component of bending moment at midship section when the ship is poised on the wave crest is accepted to be one third the value of this component determined from formula (3) for the sagging position of the ship

$$M_d^{wc} = \frac{1}{3} M_d^{wt}. \qquad (5)$$

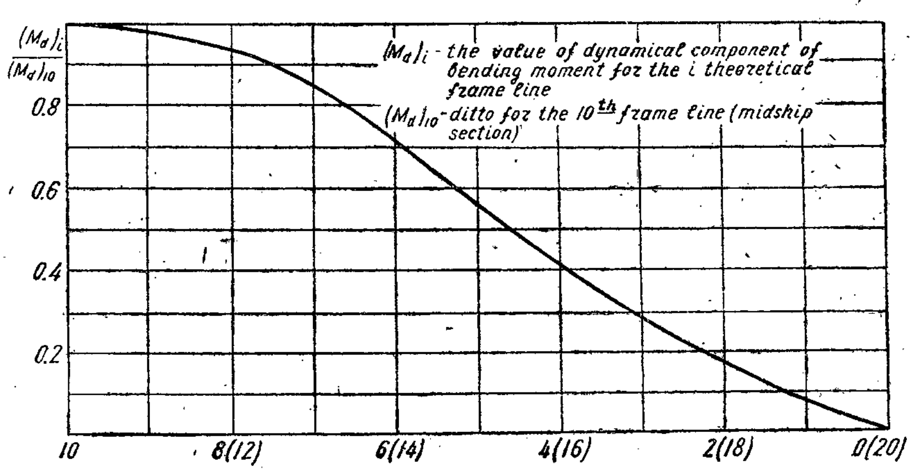

Fig. 4. Epure of distribution of the dynamical component values of the bending moment throughout the length of ship.

The values of dynamical component of bending moment at other sections throughout the length of ship shall be determined from the diagram in fig. 4.

Note. For the ships navigating in restricted areas where the maximum height of waves (h_{max}) the ship can encounter with is less than the design height of resonance waves, which is determined from the expressions (4), the value h_{max} shall substitute in the formula (3) for the value h_r when calculating dynamical component of bending moment.

407. Loading plan of a ship shall recommend the most favourable distribution of deadweight for all kinds of cargo the ship is intended to carry.

Simultaneously it is necessary to find the most unfavourable cases of distribution of deadweigth throughout the length of the ship possible under different service conditions (fully loaded, in ballast, partially loaded, with full or partially consumed stores). The inadmissible (prohibited) load variants shall be indicated in the loading plan whenever necessary.

§ 5. SELECTION OF DESIGN HULL SECTIONS AND DETERMINATION OF STRUCTURAL MEMBERS TO BE INCLUDED INTO THE SECTION MODULUS OF THE SHIP

501. The general strength of hull shall be checked for at least three sections at which the maximum stresses could be expected, i. e. at the weakest section amidships, near the front bulkheads of superstructures, at places where the framing or the material of main hull is being altered, etc.

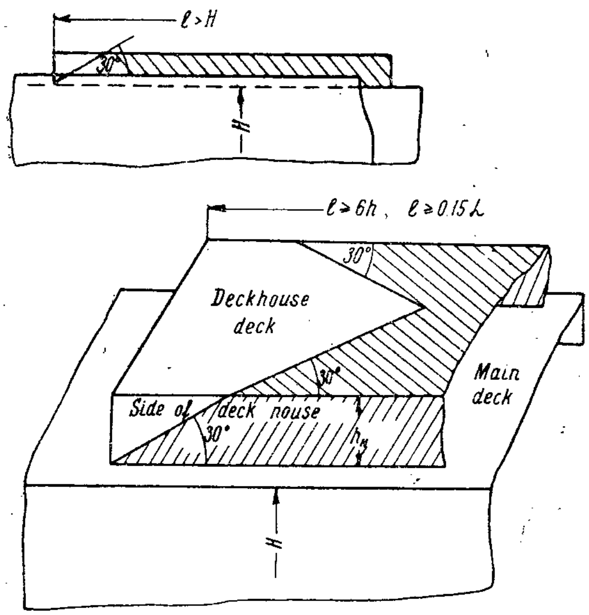

Fig. 5.

502. The Section modulus includes all longitudinal members with the length more than the depth of the ship as well as superstructures and deckhouses if their length exceeds .15 L or six heights of superstructure whichever is more. The deckhouses in this case shall be supported on at least three transverse bulkheads.

503. The discontinuous structural members mentioned in item 502 shall be included in the section modulus in accordance with fig. 5 (shadowed portions).

504. By the calculation of the section modulus the openings in the main structural members of the hull shall be taken into account as follows:

a) deck openings the breadth of which exceeds 20 per cent of the deck breadth, shall be taken into account in calculation of the section modulus and stresses. In sections forward or aft of the openings the structural members in vicinity of the transverse edges of opening shall be deleted in regions bounded by two crossing straight lines drawn from the corners of opening at the angle of 30° to the centre line as indicated in fig. 6;

b) deck openings the breadth of which does not exceed 20 per cent of the deck breadth are not taken into account when determining the section modulus, but the stresses in the deck σ_d, obtained in this case shall be increased in proportion to the ratio of deck section areas (F) disregarding these openings to that considering them (F_0)

$$\sigma_{des} = \sigma_d \frac{F}{F_0}. \tag{6}$$

The stresses may not be increased if the openings are compensated in accordance with item 505;

c) single openings having the maximum dimension (diameter) less than 20 thicknesses of plate may be not taken into account.

505. Compensation of the openings shall be carried out by increasing either the thickness of plating or the sections of longitudinals in the neighbourhood of the opening or by including additional longitudinal members (e. g. coamings). This compensation shall cover the distance of not less than the breadth of opening beyond each of its transverse edges. Only in sheerstrake the openings diameter of which exceeds the thickness 15 times shall be compensated in all cases. The compensated openings may not be checked after the requirements of the item 507 b.

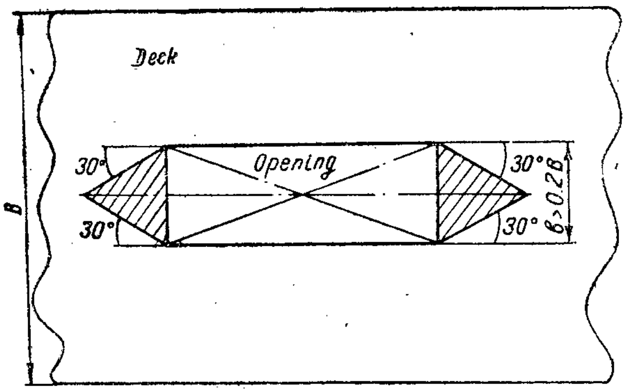

Fig. 6.

506. Measures shall be taken to decrease concentrations of stresses at the ends of discontinuous structural members and in vicinity of openings;

a) the ends of discontinuous structural members shall be gradually brought to nought or, failing that, have reinforced local attachments;

b) the openings shall have radii of corner rounding equal to at least .1 the breadth of opening; thickened plates shall be fitted at the corners of openings, etc. in accordance with present practice and with due regard for the provisions of item 508.

507. Openings in the hull plates may be not reinforced:

a) in case of single openings having breadth less than 20 plate thicknesses;

b) in case of opening with breadth more than 20 thickness of plate, if the maximum design stresses in neighbourhood of opening with due regard for the concentration of stresses do not exceed .6 yield point of steel

$$\sigma^c_{max} \leqslant .6\,\sigma_y$$

where

$$\sigma^c_{max} = \alpha\sigma_d,$$

where σ_d — the maximum stresses caused by general bend of the ship, estimated with the provisions of item 504 taken into account;

α — concentration factor, the value of which is accepted equal to 3 for round openings and determined from the diagram of fig. 7 for rectangular openings.

508. If the maximum stresses with their concentration in the vicinity of opening, taken into account do not satisfy the provisions of item 507. the plates at the opening, where the stresses are concentrated shall be reinforced. When the thickened plates are fitted, they shall have thickness

$$t_1 = t + \Delta t, \tag{7}$$

where

$$\Delta t = \sqrt{t.t_2}\left(\alpha K \frac{\sigma_d}{.6\,\sigma_y} - 1\right); \tag{8}$$

t — the initial thickness of plates in neighbourhood of the maximum concentration of stresses;

Δt — the required increase in the plate thickness (see notes given below);

$\alpha\sigma_d$ — as indicated above in the item 507;

σ_y — the yield point of material of reinforced plates;

t_2 — the thickness of plates adjacent to transverse edges of opening;

K — the coefficient determined from the diagram in fig. 8.

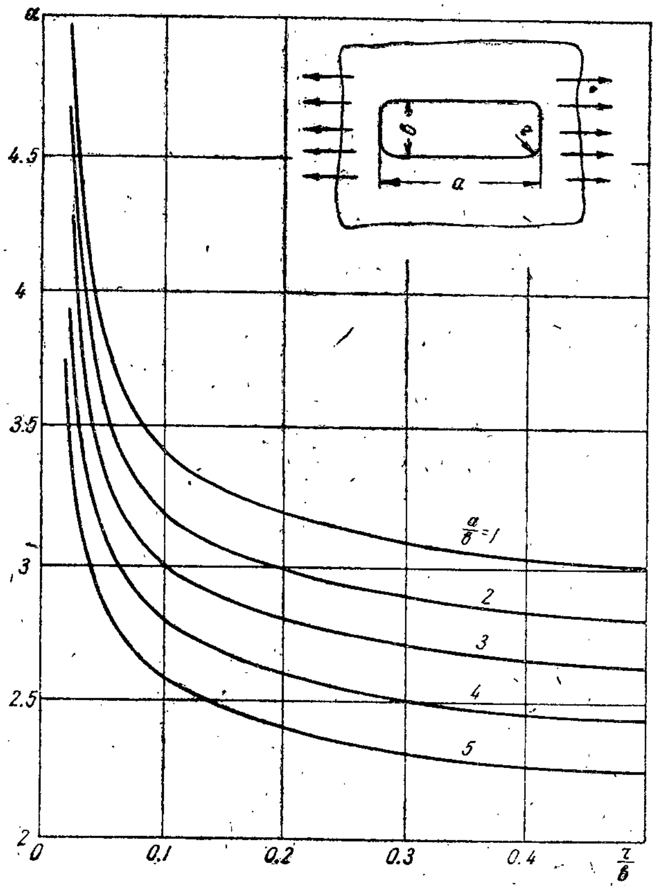

Fig. 7. Value diagram of the maximum coefficient of the stress concentration (α) — in proximity of openings.

Notes: 1. If the required increase of thickness Δt is proved to be more than the initial thickness of plates t, the steel plates with the yield point higher than that of material of the hull main structural members or other equivalent reinforcements shall be fitted in way of the maximum stress concentration.

2. If the construction of opening reinforcement satisfies the Rules, the thickening in certain cases on approval of the Register may be accepted equal to initial thickness of plates without using the steel with higher yield point.

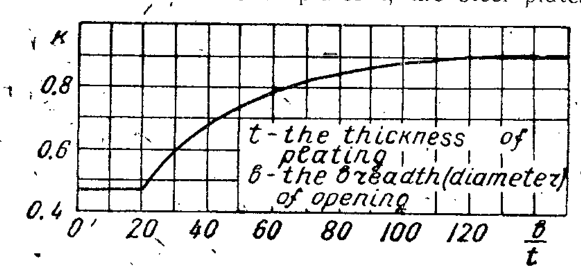

Fig. 8. Diagram of values of the coefficient K in the formula (8).

509. The structural members included in section modulus as well as the normal stresses therein shall be calculated by usual (tabular) method.

If the plates can be buckled their sectional area shall be reduced accordingly.

The strips of plates adjacent to longitudinal members with width (on each side of the longitudinal member) equal to .25 of the short side of supporting contour shall be not reduced.

510. When calculating section modulus with several degrees of approximity, such approximation shall be accepted as the final, in case of which the difference between the normal stresses caused by general bend does not exceed 5 per cent in the last and foregoing approximations.

511. The flat structures (such as decks, sides, etc.) as a whole and structural members included therein (framing, girders and plates) which are not obviously stable shall be checked for buckling.

It is necessary in this case to provide sufficient rigidity of structural members which serve as supporting contour for plates or girders affected by longitudinal compressive loading.

512. When calculating in the second and subsequent approximations the structural members included in section modulus, the portions of plates (see item 509), shall be inserted into calculation with reducing coefficient φ which may be $0 \leqslant \varphi \leqslant 1$, the coefficient φ being estimated as follows:

a) in case of longitudinal framing for the plates taking no part in bend of stiffeners due to action of local loading (generally decks, freeboard)

$$\varphi = \frac{\beta \sigma_e}{\sigma_{comp}},$$

where σ_e — the Eiler's stress of plate which is assumed to be freely supported at the contour;

σ_{comp} — the compressive stress caused by general bend and acting in rigid structural members;

β — the coefficient determined from the formula

$$\beta = 2 - \frac{a}{75t},$$

where a — the dimension of the short side of supporting contour, and

t — the thickness of plate (if the value of β is obtained >1, 1 shall be accepted);

b) for plates taking part in the bend of longitudinal framing (bottom plating, double bottom),

$$\varphi = \frac{\sigma_e + \sigma_1}{\sigma_{comp}},$$

where σ_e and σ_{comp}, as outlined in item a);

σ_1 — the stress in plate caused only by the bend of flat structure (+tension, —compression) due to loading set forth in item 608.

c) in case of transverse framing

$$\varphi = \frac{q}{\sigma_{comp}},$$

where q — the chain stress in the plate, estimated with due regard for the transverse loading acting upon the plate, for the stresses in the rigid longitudinal members adjacent thereto, and for the initial deflextion of the plate.

When $q<0$ and its value is more than σ_e of the plate, σ_e shall be accepted in lieu of q. If no data obtained from experience of construction of similar hulls are available, the initial deflection of plates shall be taken into account by the formula

$$f = \frac{a}{1500\,t}(55 + t),$$

where f — the value of maximum deflection in mm;

and a and t — the spane and the thickness of plate in mm.

The deflection shall be accepted sinusoidal.

In the first approximation the constructional deflection may be not included into calculations, and its influence shall be taken into account by means of reducing the permissible stresses by 10 per cent;

d) in case of longitudinal framing the constructional deflection shall not be taken into account;

e) when calculating Eiler's stresses in bent plates, their transverse curvature may be taken into account, influence of transverse loading upon stability of these plates shall be also taken into account (e. g. bilge plates, side plating at the ends of the ship).

513. When determining Eiler's stresses in the plates of bottom and inner bottom plating in case of transverse framing the influence of solid floors upon the rising of stability of plates shall be taken into account.

§ 6. CHECKING OF GENERAL LONGITUDINAL STRENGTH

601. The checking of general longitudinal strength includes:

a) checking of general strength on the basis of stresses caused by general bend;

b) checking of general strength on the basis of limiting moments

$$\frac{M_{\text{lim}}}{M_{\text{st}}} \text{ and } \frac{M_{\text{lim}}}{M_{\text{st}} + M_{\text{d}}};$$

c) checking of general strength on the basis of summary normal stresses acting in longitudinal members and determined as algebraic sum of stresses produced in these longitudinal members due to general bend of the ship in rough sea (under the action of M_{st}) and stresses therein caused by action of local loading;

d) checking of strength of the hull structural members when affected by shearing forces, determined by means of putting the ship statically on the crest and trough of design wave.

602. The checking of general strength on the basis of stresses shall be carried out by comparing the stresses acting in extreme laminas of the hull's section with permissible stresses specified below. The permissible stresses in fractions of yield point of steel for dry-cargo ships are given in numerator, for oil carrying ships — in denominator:

a) stresses caused by general bend when the length of ship $L \leqslant 100$ m $\frac{.50}{.45}$ when the length of ship $L \geqslant 200$ m $\frac{.60}{.55}$.

For intermediate lengths of ships the stresses are obtained by linear interpolation;

b) stresses caused by general bend and the bend of flat structures $\frac{.60}{.55}$.

Summary stresses in inner bottom plating, at the supporting sections under the bulkheads in case of transverse framing are not standardized and in case of longitudinal framing may be slightly raised on approval of the Register;

c) summary stresses caused by general bend, by bend of flat structure and by bend of stiffener in the free edge $\frac{.90}{.80}$;

d) summary stresses in plates in case of transverse and longitudinal framing $\frac{1.00}{.80}$.

603. The checking of general strength on the basis of limiting moments shall show that under both hogging and sagging conditions the ratio between the limiting and maximum bending moments when the ship is statically poised on the wave shall be

$$\frac{M_{lim}}{M_{st}} \geqslant 1.7 \text{ — for dry-cargo ships}$$

$$\frac{M_{lim}}{M_{st}} \geqslant 1.8 \text{ — for oil-carrying ships,}$$

and the ratio of the limiting moment to the bending moment calculated with due regard for dynamical component (see item 406), shall be

$$\frac{M_{lim}}{M_{st} + M_d} \geqslant -1.35 \text{ for dry-cargo ships}$$

$$\frac{M_{lim}}{M_{st} + M_d} \geqslant -1.45 \text{ for oil-carrying ships}$$

The limiting moment denotes bending moment which causes in one of the extreme laminas stresses equal to the yield point of material.

The limiting moment shall be determined for both hogging and sagging from the formula

$$M_{lim} = \sigma_y W_y,$$

where σ_y — the yield point of material of the extreme (upper or lower) hull stiff links in the section under consideration;

W_y — the modulus of resistance of the checked hull section under condition that stresses being created at the most distant from the neutral axis stiff links are equal to the yield point of material of these stiff links; the modulus of resistance shall be computed in accordance with the provisions of § 5 for cases of hogging and sagging.

The modulus section W_y (see item 604) corresponding to the limiting moment shall be at all hull sections at least 75 per cent of the value of modulus of resistance of the hull section under consideration, computed in the first approximation, i. e. disregarding the reduction of structural members due to buckling.

604. Stability of longitudinals of the upper strength deck, sheerstrake, inner bottom, side girders and bottom shall be ensured up to stresses equal to the yield point of material taking into account decrease in the modulus of normal elasticity (see the diagram of fig. 9). When it is difficult to ensure such a stability and the corrected value of Eiler's stresses in the said longitudinals (except deck and bottom longitudinals) proves to be lower than the yield point of material — the value of the limiting moment shall be determined on the basis of actual value of the corrected Eiler's stresses However, the ratio of the theoretical Eiler's stresses to the yield point in this case shall be equal at least to two.

605. The stability of deck flat structures as a whole when the hull is subjected to the limiting bending moments shall be ensured completely.

606. When calculating stability of plating the influence of variation in the modulus of elasticity upon the value of Eiler's stress in plating is not taken into account.

607. Checking of strength on the basis of the summary normal stresses shall be carried out for longitudinal members which take part in ensuring the general longitudinal strength and affected simultaneously by the local loading. Such longitudinal members include for example bottom and deck longitudinals in way of stowage of deck cargoes.

608. When assessing stresses in structural members caused by local loading (for summarizing with stresses caused by general bend) the water head to the wave profile (see also item 404 d) with due regard for the most unfavourable possible counter-pressure caused by cargoes stored in holds at the area under consideration shall be accepted as design

loading for bottom framing. However, at the wave crest the design water head shall be not less than .6 draught of the ship.

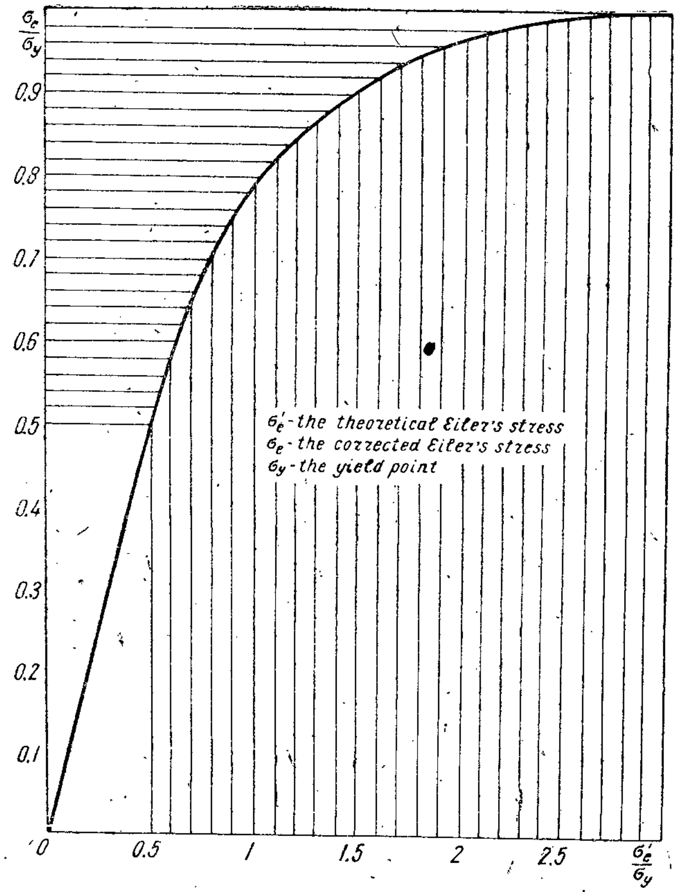

Fig. 9. Diagram for determination of the corrected Eiler's stresses (with due regard for variation in the modulus of elasticity).

For dry-cargo ships the above said counter-pressure shall be taken into account when calculating the flat structures (framing) and shall be disregarded when estimating stresses caused by bend of plates and bottom longitudinals.

For oil-carrying ships the value of counter-pressure head when summarizing shall be accepted:

a) on the wave trough — assuming that tanks are fully loaded with liquid cargoes of the maximum specific gravity;

b) on the wave crest — assuming that tanks are empty, i. e. there is no counter-pressure.

For longitudinal members of hull not affected by sea water pressure, the weight of cargo or ballast shall be accepted as design local loading.

609. The hull strength shall be checked for the action of shearing forces in at least two hull sections under both hogging and sagging conditions by comparing the shear stresses acting in neighbourhood of the maximum of shearing forces (forward and aft) in way of the neutral axis, the permissible stresses being equal to $.3\sigma_y$.

For side plating the double margin of stability shall be ensured for shear stresses.

The thickness of longitudinal bulkheads in case of unsufficient stability of the bulkhead plates in relation to shearing forces shall be accepted with due regard for reduction coefficient equal to the ratio between the Eiler's shear stresses and design ones.

610. For ships with length to depth ratio exceeding 15 the maximum deflection shall be not more than 1/400 length of the ship under action of the maximum bending moment.

Deflection curve of the ship shall be plotted using at least ten ordinates.

611. Rigidity of decks shall be checked whenever necessary (when travelling cranes and metal hatch covers are used on board ship, to ensure their proper operation).

612. Compliance of hull general strength with requirements of the Rules is checked by comparing the acting stresses (due to general bend and summary) and the limiting moments (calculated in accordance with item 603) in the hull structures designed according to these Standards with those stresses and limiting moments which should have been if the hull were fully complied with the Rules.

CHAPTER III

COLCULATIONS OF HULL LOCAL STRENGTH

§ 7. GENERAL INSTDUCTIONS ON LOCAL STRENGTH CALCULATION

701. General instructions on framing calculation.

When calculating the flat structures, frames and continuous girders, the following general provisions shall be taken into account:

a) the spans of members forming transverse frames are accepted as distances between points of intersection of the neutral axises of corresponding girders;

b) alteration in the member's section, produced by brackets, when the system is found to be statically indeterminable may be not taken into account;

c) presence of brackets is taken into account when assessing stresses at sections of framing, i. e. the section modulus of members is calculated with due regard for brackets. This requirement shall be, in particular, fulfilled obligatory in regard to bilge brackets of hold frames and all web girders (floors, web beams, web frames, stanchions, centre keel, side girders, horizontal webs on bulkheads) of oil-carrying vessels.

702. Strength calculation for bottom structure.

In general cases the bottom structure is considered as a system of intersecting girders of two directions (floors — the girders of main direction, stringers and keel — the cross girders).

For bottom structures of dry-cargo ships the floors may be in general counted as freely supported at the sides, and crossing girders — rigidly fixed at transverse bulkheads.

In certain cases, if the lengths of adjacent compartments or the values of their local loading differ appreciably, the more precise definition of the value of supporting couple restraint coefficient for crossing girders may be required.

When calculating bottom structure of the middle compartments of oil-carrying vessels the floors may be in general considered as fixed rigidly at longitudinal bulkheads and centre keel and side girders — at transverse bulkheads.

The spans of girders (floor, keel and stringers of oil-carrying ships) shall be considered as a distance between corresponding bulkheads.

It is necessary for bottom structure to check the value of shear stresses in webs of supported sections of girders.

The supported sections of keel and stringers can require checking of web strength on the basis of octahedric stresses.[1] In certain cases, when these stresses exceed the yield point, the bottom structure should be calculated taking into account re-distribution of load between the crossing girders and floors.

703. Strength calculation for side framing.

In case of transverse side and deck framing of dry cargo ships the stresses in frames and beams shall be generally estimated in accordance with regulations for transverse frame calculation.

When calculating transverse frame the lower end may be considered as fixed rigidly and the span of the hold frame shall be measured to the point of its intersection with the neutral axis of the floor. The frames may be calculated as continuous girders observing the above said instructions on fixing and span of the hold frame.

In oil-carrying ships in case of transverse side framing the frames may be considered as continuous members for which the side stringers are fixing supports.

The side stringers shall be calculated as girders elastically restrained at transverse bulkheads.

When the side stringers are bound with the horizontal girders of longitudinal bulkheads, the system of girders bound by cross-bars may be calculated.

In case of longitudinal side framing of oil-carrying ships the longitudinals shall be calculated as members fixed at web frames.

Web frames shall be calculated as girders elastically restrained at deck and bottom, and if they are bounded with web stiffeners of longitudinal bulkheads, combined work of these girders shall be taken into consideration.

Web frames may be calculated as a part of continuous girders including web floors and beams.

704. Calculation of deck structures.

In case of transverse deck framing the beams shall be generally calculated as a part of transverse frames.

The beams may also be calculated as continuous members elastically restrained at sides.

Half beams in way of large openings should be considered as freely supported at carlings (coamings).

For lower cargo decks when calculating half beams as a part of transverse frames (or when calculating a member elastically restrained at side), the settling of cargo hatch coaming shall be taken into consideration.

The strengthened end beams together with the carlings shall be calculated as a system of intersecting girders.

In case of longitudinal framing the longitudinals shall be calculated as rigidly fixed at web beams.

Web beams may be calculated as continuous girders; in case of transverse side framing the web beams may be considered as freely supported at the sides. In case of longitudinal side framing the restraint of web beams shall be taken into account.

705. Strength calculation for bulkheads.

Stiffeners of transverse bulkheads of dry-cargo ships if there are crossing girders and intermediate decks shall be considered as continuous members. Attention shall be paid to proper determination of conditions for securing the stiffener's ends depending on their construction.

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[1] $\sigma_{oct} = \sqrt{\sigma^2 + 3\tau^2}$,

where σ — the normal stress caused by general bend in halfway up the web;
τ — the shear stress in the web.

Stiffeners when horizontally arranged shall be calculated as rigidly fixed at vertical web stiffeners.

Horizontal girders and web stiffeners of transverse bulkheads of oil-carrying ships shall be calculated as a system of crossing girders.

706. Strength calculation for hull plates.

Stresses in plates of shell deck, inner bottom and bulkhead caused by transverse loading (pressure head) shall be estimated on assumption that plates are fixed at supporting contour.

If the ratio of supporting contour sides exceeds 2.5—3.0 the plates may be considered as cylindrically deformed.

In case of need the thrust and chain stresses produced in plate due to the thrust shall be taken into consideration.

If the ratio of the smaller span of the plate to its thickness does not exceed 50—60, the plates shall be calculated as completely rigid.

707. Besides fulfilling the present chapter provisions, the requirements of the Rules as regards structure of framing and members (e. g. intersection of longitudinals with transverses), all kinds of reinforcements, strengthenings and bonds (e. g. shell plating in way of propeller shafts and hawse pipes) as well as change in thickness of the structural members throughout cross section and length of the ship (thickening of sheerstrakes, deck stringers, plate keel, etc.) shall be also satisfied.

708. When checking the strength of bottom and side structures, the strength of supporting structures (decks, platforms, bulkheads, etc.) shall be also checked for the maximum reactive loads transferred from the above said structures.

The decks, platforms and bulkheads which serve as supports for other flat structures (sides, decks, bottom or bulkheads) shall be checked for the maximum reactive loads transferred from the above said flat structures with ensuring the one-and-a-half margin of stability (of the framing) when affected by the above mentioned loads.

709. In addition to checking of strength of the structure, it is necessary in accordance with the provisions of the present chapter, to check the summary stresses of all hull longitudinal members which besides local strength ensure general strength of the ship. The local loading shall be accepted in this case as that set forth in item 608.

The checking of local strength on the basis of loading specified below shall be carried out for structures of the hull; the longitudinal members being assumed as taking no part in general bend.

710. When determining design pressure water heads caused by local loading from the formulae (see §§ 8—12) the following symbols are accepted:

h_{dph} — the design pressure head in metres of water column;
d — the summer load draught with trim taken into account;
h_w — the design wave height;
z_i — the distance between the centre of plate or horizontal structural member and the base line;
H_{sec} — the depth of hull at a section under consideration;
H — the depth of hull amidships;
H_b — the design height of bulkhead;
L — the length of the ship at the summer load line;
q_{car} — the counter-pressure of the cargo in metres of water column;
h_{hold} — the height of hold;
h_{tw} — the height of the cargo space between deck platings;
h_{ap} — the vertical distance from the lower edge of tank to the upper level of air pipe;
h_t — the height of tank.

The enumerated values are given in metres. The permissible stresses are given in percentage of the yield point of steel used.

§ 8. SHELL PLATING

801. When calculating shell plating the loading is accepted as uniformly distributed.

The stresses in shell plating caused by local loading shall be determined for side plates, the lower edge of which adjoins to the bilge.

802. The design loading for dry cargo ships shall be defined by the following pressure head: the draught plus one half of the wave height with the provisions of item 404 d taken into account (but not less than the depth of the section under consideration) minus the ordinate of the plate centre above the base line

$$h_{dph} = d + \frac{h_w}{2} - Z_i,$$

where

$$d + \frac{h_w}{2} \geqslant H_{sec}.$$

The permissible normal stresses at the supporting sections of plates .8σ_y.

803. The thickness of side plating shall be accepted as equal to at least, that of the plate adjoining to bilge throughout the full height from bilge to sheerstrake.

804. When estimating the thickness of plating the provisions of § 16 shall be also taken into account.

§ 9. BOTTOM FRAMING

901. The loading uniformly distributed upon the bottom structure and corresponding to the following pressure head is accepted to be design loading for floors of dry cargo ships: the draught plus one half of the design wave height with the provisions of item 404 d taken into account (but not less than the hull's depth at the given section) minus the counter-pressure of the cargo in hold or machinery in engine room. The pressure head so calculated shall be not less than .6 draught of the ship

$$h_{dph} = d + \frac{h_w}{2} - q_{car},$$

but not less than .6 d and $d + \frac{h_w}{2}$ shall be not less than H_{sec}.

The counter-pressure of the cargo shall be included into calculation for the case of stowage of the hold, when design loading upon the bottom is the most unfavourable

Normal stresses in floor girders $\sigma = .60\sigma_y$.

Shear stresses in floor webs $\tau = .35\sigma_y$.

902. If a dry cargo ship can sail with some empty holds, the following pressure head shall be considered as design: the draught plus one half of the design wave height (but not less than the depth of the given section), disregarding the counter-pressure of cargoes in holds

$$h_{dph} = d + \frac{h_w}{2},$$

but not less than H_{sec}

Normal stresses in floor girders $\sigma = .9\sigma_y$.

Shear stresses in floor webs $\sigma = .5\sigma_y$.

903. The loading uniformly distributed upon the bottom structure and corresponding to the following pressure head: the draught plus one half of the design wave height with the provisions of item 404 d taken into

account (but not less than the depth of the given section), shall be considered as design loading for the floors of oil-carrying ships:

$$h_{dph} = T + \frac{h_w}{2},$$

but not less than H_{sec}.

Normal stresses in floor fore area $\sigma = .5\sigma_y$.
Shear stresses in floor webs $\tau = 25\sigma_y$.

904. The design loading upon the bottom structure shall be determined taking into account the reactive loads transferred from above decks, platforms depending on accepted arrangement of pillars and carlings.

905. The bottom structures shall be in addition checked for reactions of keel blocks when the ship is docked or built and ready to launching (see § 13).

906. The plating and stiffeners of the inner bottom in holds shall be checked:

a) for action of the pressure head $h_{dph} = \frac{h_{hold}}{1.35}$. (if cargo weight per value unit exceeds .75 t/m³, the design pressure head shall be increased accordingly).

The loading caused by the pressure of cargo upon the inner bottom of the ore-carriers shall be accepted on the basis of cargo distribution in the holds in proportion to their volumes. This loading shall be increased by 20 per cent to take into account the nonuniformity of stowage.

Normal stresses:

in supporting sections of plates $\sigma = .80\sigma_y$.
in free edges of stiffeners $\tau = .60\sigma_y$.

b) for test pressure head of the double bottom to the top of air pipe

$$h_{dph} = h_{ap} - Z_l.$$

The stresses at span of the plates and in free edges of stiffeners $\sigma = .8\sigma_y$.

907. The plating and framing of inner bottom of the dry cargo ships carrying heavy bulk cargoes or those unloaded by clam-shells shall be reinforced according to instructions of the Register.

§ 10. SIDE FRAMING

1001. The uniformly distributed loading corresponding to the following pressure head shall be accepted as design loading for horizontal structural members: the draught plus one half of the design wave height with the provisions of item 404 d taken into account (but not less than the depth) minus the ordinate of the structure member under calculation from the base line

$$h_{dph} = d + \frac{h_w}{2} - Z_i,$$

where $d + \frac{h_w}{2}$ is accepted to be not less than H_{sec}.

The triangular or trapezoidal loading with the maximum pressure head at the level of base line equal to the draught plus one half of the design wave height with the provisions of item 404 d taken into account but not less than the depth of hull, shall be considered as design loading for vertical structural members

$$h_{dph} = d + \frac{h_w}{2},$$

but not less than H_{sec}.

1002. The permissible normal stresses in framing:

for dry-cargo ships $\sigma = .80\sigma_y$,
for oil-carrying ships $\tau = .5\sigma_y$.

The hold frames of dry cargo ships shall be in addition checked for loading corresponding to summer draught with the trim taken into consideration.

For dry cargo ships the permissible normal stresses in hold frames $\sigma = .5\sigma_y$.

In case of longitudinal side framing the section of each of the three upper girders is accepted to be equal to that of the forth girder from the top.

1003. In case of curvature of the side framing the design length of the structural member is taken along the chord connecting the extreme points of the neutral axis of girder.

1004. The framing of sides in fore and aft ends of the ship shall be assigned in accordance with the provisions of item 1603.

1005. Reinforcements of the side framing to ensure sailing in ice shall be assigned in accordance with item 1604.

§ 11. DECKS AND PLATFORMS

1101. The design loading for decks and platforms of dry cargo ships is a loading uniformly distributed upon the deck structure and corresponding to the pressure head h_{dph} equal to:

1. For upper open continuous decks (beams, longitudinals, web beams) depending on the ship length and relative draft (for intermediate values of L and $\frac{d}{H}$, the pressure head is obtained by linear interpolation)

When $L = 60$ m the pressure head $h_{dph} = .8$ m.

if $\frac{d}{H} \leqslant .70$ and $h_{dph} = 1$ m when $\frac{d}{H} \geqslant .85$.

When $L \geqslant 140$ m and the pressure head $h_{dph} = 1.6$ m.

if $\frac{d}{H} \leqslant .70$ and $h_{dph} = 1.8$ when $\frac{d}{H} \geqslant .85$.

2. For upper deck when timber is carried the design pressure head is accepted to be equal to 2 m of water column. If due to the stowage height and specific gravity of the timber the loading upon the deck can exceed 2 m of water column, it should be determined on the basis of actual weight of the timber loaded on deck.

3. For intermediate decks designated for carriage of cargoes $h_{dph} = \frac{h_{tw}}{1.35}$, if the deck is designated for cargo which volume weight exceeds .75 t/m^3, the design pressure head shall be increased accordingly.

4. For decks, to beams, or longitudinal girders of which a cargo (e. g. carcasses of meat) is suspended, the value of design pressure head shall be increased correspondingly; in case of suspension of meat carcasses the design pressure head shall be increased by at least .55 m per row of suspended carcasses.

5. For decks on which accomodations are arranged $h_{dph} = .5$ m, however at the requirement of the Register this design pressure head may be increased to take into account different additional factors. If the accomodation deck ensure watertightness when the compartment under this deck is flooded then it shall be calculated for the maximum pressure head equal to the height of water column from the margin line to accomodation deck.

6. For superstructure deck:

a) for forecastle deck the same head as for upper deck;

b) for long bridges and poops the same head as for upper deck but not more than:

$$h_{dph} = 1.2 \text{ m};$$

c) for short bridges and poops

$$h_{dph} = .9\ \text{m};$$

d) for promenade and boat decks — .6 m and .5 m of water column accordingly.

Normal stresses in web beams, beams and carlings

$$\sigma = .6\,\sigma_y.$$

1102. Design loading upon decks and platforms shall be determined with due regard for the reactive forces transferred from the above decks and platforms depending on accepted construction and arrangement of carlings and pillars.

1103. Design loading for decks of ships carrying heavy cargoes, see item 1401.

Permissible normal stresses in deck framing $\sigma = .7\sigma_y$.

1104. The strength of deck framing of the oil-carrying ships is checked for pressure of oil from inside of oil tanks completely filled with the ship listed to 30 degrees disregarding pressure of water got on the deck.

Normal stresses in free edges of deck framing $\sigma = .5\,\sigma_y$
Shear stresses at webs $\tau = .25\,\sigma_y$

1105. Decks (platforms) of fresh and ballast water compartments. Design loading is defined by test pressure head from the plating to the top of air pipe, but not less than to the level 2,5 m above the bulkhead deck.

Normal stresses in framing and supporting sections of plates $\sigma = .8\sigma_y$.

§ 12. BULKHEADS OF MAIN HULL AND SUPERSTRUCTURES

A. Watertight bulkheads of dry cargo ships

1201. The triangular or trapezoidal loading with the maximum pressure head at the level of the base line equal to the distance to the strength deck, is considered as design loading

$$h_{dph} = H_b.$$

Normal stresses in framing and span sections of plates $\sigma = .8\,\sigma_y$.

The uniformly distributed loading corresponding to the pressure head equal to depth to bulkhead deck minus the ordinate of structural member under calculation is considered to be the design loading for horizontal members

$$h_{dph} = H_b - Z_i.$$

Normal stresses in framing and span sections of plates $\sigma = .8\,\sigma_y$.

B. Bulkheads of fresh and ballast water compartments, fore and after peaks

1202. Design loading is of the same character as that given in item 1201, but the maximum pressure head is taken to the upper end of air pipe and shall be at least 1 m above the bulkhead deck in this area

$$h_{dph} = h_{ap},$$

but not less than $H_b + 1$ m.

Normal stresses in framing and span sections of plates $\sigma = .8\,\sigma_y$.

When the pressure head is maximum and extends to the top of tank, $h_{dph} = h_{tt}$.

Normal stresses in framing and span sections of plates $\sigma = .6\,\sigma_y$ in case of alternate loading on both sides, the stresses in plates at the supports shall be not more than $\sigma = .80\,\sigma_y$

C. Oiltight bulkheads (main bulkheads of tankers, bulkheads of fuel and lubricating oil tanks)

1203. The uniformly distributed loading equal to the water pressure head from the structural member under calculation to the highest level of oil (fuel, lubricating oil) possible in service with due regard for the air pipe, but not less than 2,5 m above the tank top is considered as design load for horizontal structural members

$$h_{dph} = h_{ap} - Z_l ,$$

but not less than $h_t + 2.5 - Z_l$ (m of water column).

The trapezoidal loading with the maximum pressure head at the level of the base line, equal to the distance from the base line to the top of air pipe, but less than 2.5 m above the tank top, is considered as design loading

$$h_{dph} = h_{ap} ,$$

but not less than $h_t + 2.5$ m.

Normal stresses in framing $\sigma = .55\,\sigma_y$.
In supported sections of plates $\sigma = .9\,\sigma_y$.

1204. The strength of longitudinal bulkheads of main hull (oil-carrying ship) as regards normal and shear stresses shall be ensured in accordance with the provisions of the relevant Standards (items 607 and 609 of § 6).

D. Bulkheads of superstructures and deckhouses

1205. Bulkheads of superstructures of the first tier are calculated for static uniform loading at assumed pressure head h_{dph} in metres of water column.

For front bulkheads $h_{dph} = .07\,L + 1$.
For side bulkheads $h_{dph} = \frac{1}{2}(.07\,L + 1)$.
For stern bulkheads $h_{dph} = \frac{1}{4}(.07\,L + 1)$.
L — the length of the ship on the summer water line in metres.

The pressure head for bulkheads of the second tier is accepted correspondingly as a half the value of that for bulkheads of the 1st tier.

When the draught $d \geqslant .8$ H the loading h_{dph} shall be increased by 10 per cent and when the draught $d \leqslant .7$ H the loading may be decreased by 10 per cent.

Normal stresses in framing and spans of plates $\sigma = .8\,\sigma_y$
Stresses in supporting sections of plates $\sigma = 1.0\,\sigma_y$

The design loading (pressure head) for bulkheads, superstructures and deckhouses of ships of restricted area of navigation may be reduced in proportion to the ratio of the wave height in the given restricted area to that estimated for the ship in accordance with the provisions of item 403 b § 4.

§ 13. STRUCTURAL MEMBERS AFFECTED BY FORCES PRODUCED WHEN THE SHIP IS LAUNCHED AND DOCKED

1301. Strength calculation of the ship when docked shall be generally carried out on assumption that the ship lies on one row of keel blocks.

Forces acting upon the hull of a ship when docked are calculated for the light ship with due regard for variable rigidity of hull, rigidity of keel blocks and influence of overhanging ends of the ship.

The releasing influence of final rigidity of bottom upon distribution of reaction of keel blocks shall be taken into account in the calculation.

1302. Stability of structural members (as regards normal and shear stresses) when the ship is docked shall be ensured with the margin coefficient 1.5.

1303. Strength calculation when the ship is launched shall be carried out for the most dangerous position of the ship in the prossess of the launching with due regard for the variable rigidity of hull as well as for the rigidity of launching arrangements and building berth foundation.

Releasing influence of the final rigidity of bottom may be taken into account.

1304. The permissible stresses when the ship is docked and launched are as follows:

Normal stresses caused by general bend $\sigma = .6\sigma_y$.
Normal local stresses $\sigma = .8\sigma_y$.
Shear stresses caused by general bend $\tau = .35\sigma_y$.
Shear local stresses $\tau = .45\sigma_y$.

§ 14. INSTRUCTIONS FOR CONSIDERATION OF INERTIA AND VIBRATION FORCES

1401. When calculating the structural members for action of inertia forces in a seaway the angles of heel and trim are accepted to be 40 and 5 degrees accordingly.

When calculating masts and deckhouses the wind pressure is accepted to be .2 t/m².

Stresses in masts, deckhouses and machinery foundations affected by inertia forces:

Normal stresses in structural members $\sigma = .70\sigma_y$,
Shear stresses in structural members $\tau = .40\sigma_y$.

1402. The frequency of the 1st tone free oscillations of hull shall be determined to establish the most unfavourable service conditions for the ship.

1403. When checking vibration of the structural members coming into contact with liquid (water, fuel, etc.), the frequencies of natural oscillations shall be determined with due regard for joint mass of water (when calculations are made in accordance with item 104 b).

§ 15. WIDTH OF CONJUNCTIVE PLATING

1501. When determining section elements of flat structure framing members the width of strip of plating adjacent to the members shall be taken into account as follows:

a) when calculating members of main direction (e. g. longitudinals in case of longitudinal framing; frames, beams and floors in case of transversal framing; stiffening ribs or bulkhead stiffeners) the width of effective strip shall be determined from the formula

$$c = a,$$

where a — the arithmetic mean value of the distance from the member under consideration to adjacent members of main direction (fig. 10).

b) When calculating crossing girders (e. g. web beams, web frames and floors in case of longitudinal framing; carlings, side and side girders in case of transverse framing, bulkhead shelves in association with vertical stiffeners, bulkhead web stiffeners in association with horizontal stiffeners) the width of effective strip shall be determined from the formula

$$c = b,$$

where

b — the arithmetic mean value of the distances from the girder under consideration to adjacent crossing girders (fig. 10).

c) When calculating reinforced members (girders) of main direction which support crossing girders (e. g. carlings, side and bilge stringers in case of longitudinal framing; web stiffeners of bulkheads with vertical stiffeners in association with shelves; shelves of bulkheads with horizontal stiffeners in association with web stiffeners) the area of plate and sectional areas of intermediate stiffeners are included into the calculation.

The width of the plate is determined by the formula

$$c = d,$$

where

d — the arithmetic mean value of the distances from the girder under consideration to adjacent reinforced girders of main direction (fig. 10).

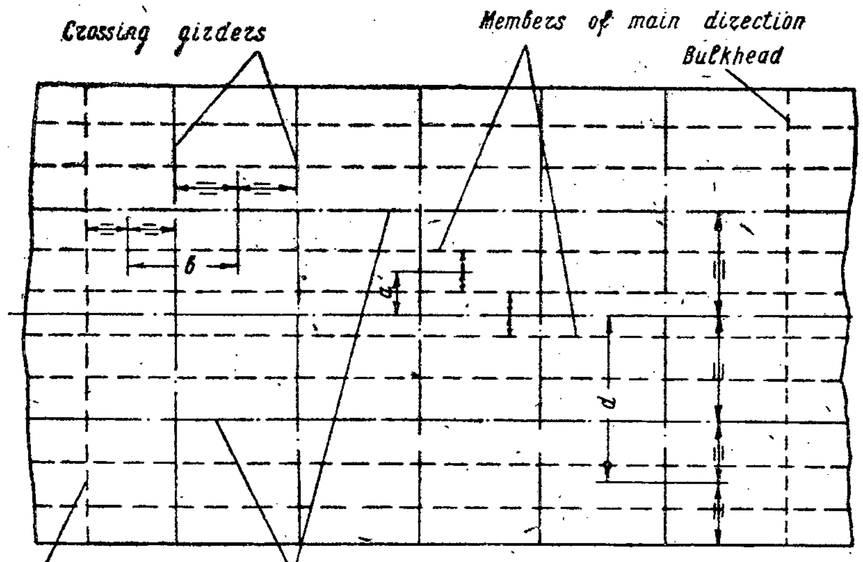

Fig. 10.

1502. When calculating stability to determine the sectional areas of girders the width of the effective strip is accepted as given above and when determining inertia moments of transverse section of girders the width of the effective strip is accepted to be equal to half the strip width after item 1501.

1503. The width of effective strip of the ship's framing girders in all cases specified in item 1501 and in item 1502 only, when determining the inertia moment shall not exceed 1/6 member span.

§ 16. FRAMING OF HULL'S ENDS, STRENGTHENING FOR NAVIGATION IN ICE AND REINFORCEMENTS OF HULL, STRUCTURAL MEMBERS NOT CALCULATED AFTER THESE STANDARDS

1601. Structural members of ship ends (shell plating, frames, deck with beams, etc.) are assigned in pursuance of the Rules with due regard for the following provisions (items 1603, 1604, 1605).

1602. When using high tensile steel (yield point of which exceeds 2400 kg/cm²) the structural members shall be of equivalent strength to that required by the Rules. Structural members affected by transverse loading are considered as equally efficient, if the loading corresponding to normal stresses equal to the yield point of the material and produced at the extreme layers of member sections, are identical; it applies equally to loading causing tangential stresses equal to .57 σ_y in the webs of girders; for the structural members affected by longitudinal loading, the identical stability shall be ensured.

The aforesaid general provisions result in the following concrete conditions of equal efficiency:

a) sections modulus of the girders affected only by transverse loading when the spans and attachment conditions are identical, shall satisfy the ratio

$$\frac{W_1}{W_0} = \frac{S_1}{S_0} \cdot \frac{2400}{\sigma_y},$$

where

W_1 — the section modulus of the girder made of the high tensile steel;
W_0 — ditto for the girder after the Rules;
S_1 — the distance between the girders in the structural member of high tensile steel;
S_0 — ditto after the Rules.

b) thickness of the shell plates, affected by transverse loading shall satisfy the ratio

$$\frac{t_1}{t_0} = \frac{S_1}{S_0} \sqrt{\frac{2400}{\sigma_y}},$$

where

t_1 — the thickness of plates made of the high tensile steel;
t_0 — ditto after the Rules.

Note. It is assumed that the ratio of the supporting contour sides of the shell plating exceeds 2.5.

c) for girders which may be affected by compressing forces and which are required to ensure stability (e. g. hold beams in ends, deck beams in way of ice strengthenings) the inertia moments when the spans and attachment conditions are identical, shall satisfy the ratio

$$\frac{I_1}{F_1} = \frac{I_0}{F_0} \cdot \frac{\sigma_y}{2400},$$

where

I_1 — the inertia moment of the section (with the effective strip of plating) for the profile of high tensile steel;
I_0 — ditto for the profile after the Rules;
F_1 — the sectional area of the profile (with the effective strip of plating taken into consideration) of high tensile steel;
F_0 — ditto for the structural member after the Rules.

The formula mentioned above may apply also to pillars.

d) the plates forming the webs of girders (webs of floors, web frames, side stringers, etc.) shall satisfy the following ratio to ensure their stability

$$\frac{t_1}{t_0} = \sqrt[3]{\left(\frac{S_1}{S_0}\right)^2 \cdot \frac{h_0}{h_1}},$$

where

S_1 — the distance between ribs stiffening the webs when high tensile steel is used;
S_0 — ditto for the structural member after the Rules;
h_0 — the web height accepted in accordance with the Rules;
h_1 — ditto when the high tensile steel is used.

When the above mentioned ratio is satisfied the identical margin of stability will be ensured in regard to the acting shear stresses.

1603. The strength of the bottom and side structural members at the forward end of the ship for a distance from the stem aft equal to .35 L shall be checked for the action of hydrodynamic pressures caused by impact of sea wave.

The values of hydrodynamic pressures for action of which the strength of longitudinal framing and shell plates are checked, shall be determined from the formula

$$p_i = mc_i h_r,$$

where

p_i — the design value of hydrodynamic pressure in t/m²;

m — the coefficient determined from the diagram in fig. 11;

c_i — the coefficient determined from the diagrams in fig. 12 and 13 and from the formula

$$c_i = c_0 \cdot \frac{c_i}{c_0};$$

h_r — the height of resonance wave, computed in accordance with the provision of item 406.

The strength of floors and bottom structures as a whole shall be checked for the action of uniformly distributed pressure equal to .6 p_m, where p_m — the arithmetic mean value of hydrodynamic pressures, determined by the formula $p_i = mc_i h_r$ for five points equidistant throughout the perimeter of the frame under consideration (when calculating the bottom structure as a whole — throughout the perimeter of frame at the middle of the considered length of bottom structure).

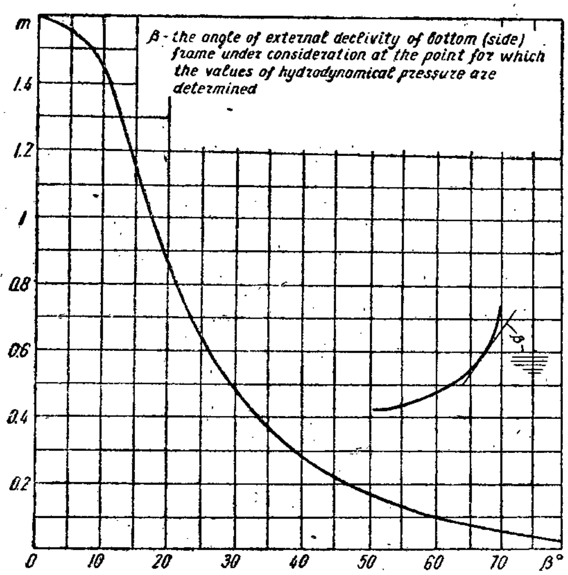

Fig. 11. Diagram of coefficient m values.

1604. The structural members of ships of classes Л and УЛ shall be strengthened in accordance with the provisions of the Rules; the shell plating and framing in way of ice strengthenings shall be of equivalent strength to that required by the Rules.

1605. The thickness of tweendeck deck plates is accepted in accordance with the Rules.

1606. Arrangement and dimensions of pillars are selected from the Rules and are checked by calculation whenever necessary.

§ 17. WELD SEAM STRENGTH

1701. The strength of butt joints and tee joints with complete penetration of weld metal throughout the adjacent surfaces shall not be checked, since:

a) throat thickness exceeds the section of at least one of the joint elements;

b) sequence of welding operations ensures welding joints strength of which is equivalent to that of the base metal.

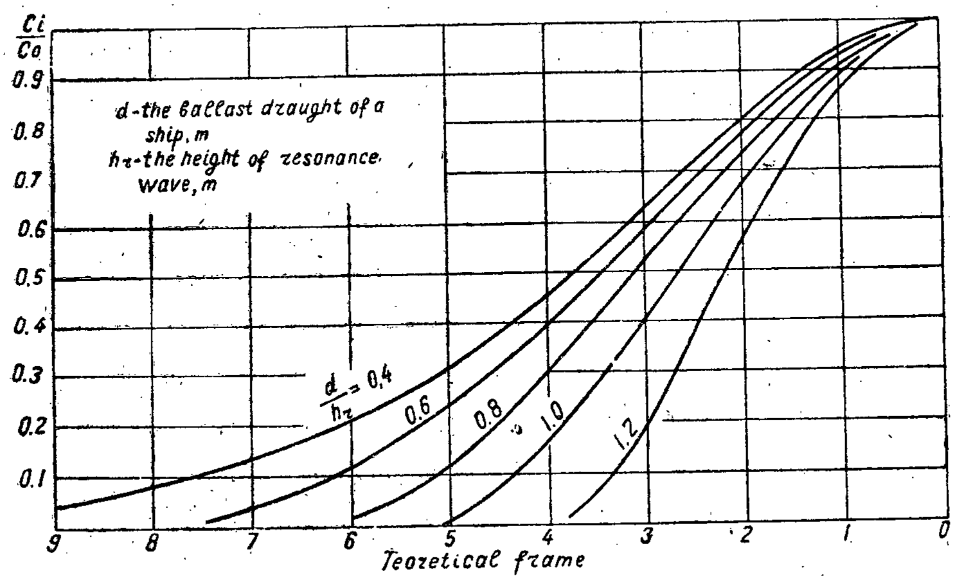

Fig. 12. Diagram of coefficient c relative values for different sections throughout the ship's length.

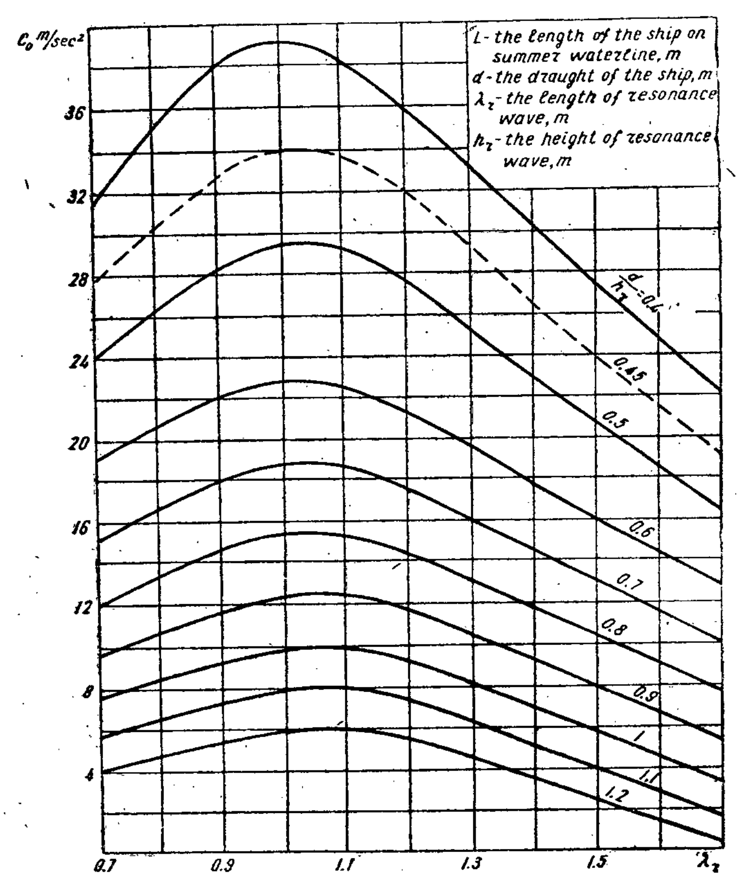

Fig. 13. Diagram of coefficient c_0 values for the zero frame line (stem).

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REGISTER OF SHIPPING OF THE USSR

STANDARDS OF LIFE-SAVING APPLIANCES FOR SEA-GOING AND ROADSTEAD SHIPS
1958

Publishing House „Morskoj Transport“
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РЕГИСТР СОЮЗА ССР

НОРМЫ СНАБЖЕНИЯ СПАСАТЕЛЬНЫМИ СРЕДСТВАМИ МОРСКИХ И РЕЙДОВЫХ СУДОВ 1958 года

ИЗДАТЕЛЬСТВО «МОРСКОЙ ТРАНСПОРТ»
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*Approved
by the Ministry of
Shipping of the USSR
Order No. 28
January 31, 1958.*

CHAPTER I

General Provisions

§ 1. Standards of Life-Saving Appliances for Sea-Going and Roadstead Ships are established by the Register of the USSR[1] at the level of modern achievements of the international maritime practice and in compliance with provisions of the International Convention for the Safety of Life at Sea, 1948.

§ 2. These Standards come into force on the first day of July, 1958, and apply to all new ships:

a) passenger and cargo ships engaged on international voyage the keel of which was laid on the 10th of August, 1954, or after that date, as well as passenger ships converted from cargo ships on or after that date;

b) passenger, cargo, research, fishing and other ships engaged on voyages which are not international voyages, the keel of which was laid on the day of coming into force of these Standards or after that date, as well as passenger and research ships, whale and fish processing or canning factory ships converted from cargo ships on and after that date.

All other ships are considered as existing ships.

§ 3. In the case of existing ships provisions shall be made in order to bring their life-saving appliances in compliance with the requirements of these Standards so far as this is reasonable and practicable without any considerable alterations in ship's structure.

The extent of fulfilment of the requirements of the Standards in existing ships which are subject, to big repair, re-equipment or modernization is determined in each case by the Shipowner and approved by the Register.

§ 4. The ships engaged on international voyages and meeting all requirements of the present Standards shall have special certificates issued by the Register:

1) Safety certificate (for passenger ships);

2) Safety equipment certificate (for cargo ships).

§ 5. If it is impracticable and unreasonable to apply fully these Standards, the Register may exempt certain ships or categories of ships from any of the requirements relating to life-saving equipment.

The said ships may comprise ships engaged on international voyages, proceeding to sea and plying not more than 20 miles from the land, ships carrying large number of unberthed passengers and some other ships, the character of voyage and conditions of navigation of which in the opinion of the Register comply with the requirements of safety.

§ 6. Ships engaged on international voyages and exempted from any of requirements of the Standards shall have the "Exemption Certificate" issued by the Register.

§ 7. Construction, stability, strength, technology of life-saving appliances manufacturing and other questions are not considered in these Standards.

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[1] The Register of the USSR is hereafter called "Register".

§ 8. From the moment the present Standards come into force, the "Rules for equipping ships with life-saving appliances" issued by the Register in 1932—1935 are to be cancelled.

CHAPTER II

Categories of sea-going and roadstead ships

§ 9. In regard to the Standards of life-saving appliances the sea-going and roadstead ships are subdivided into four categories according to their areas of navigation:

A. Ships of Category I — of unrestricted navigating area:

1) Ships engaged on long international and noninternational voyages;

2) Ships navigating between the ports of the USSR, situated on various seas except Black and Azov Seas;

3) Ships navigating in Arctic and Far East Seas[1], except Japan Sea.

B. Ships of Category II — sea navigating area:

1) Ships engaged on short international voyage up to 600 miles, plying not more than 200 miles from the ports of refuge;

2) Ships navigating between the ports of the USSR situated on the same sea (the Baltic, Black, Caspian Seas);

3) Ships navigating between the ports of Black and Azov Seas.

C. Ships of Category III — of coastal navigating area:

1) Ships navigating within 20 miles from the port of refuge;

2) Ships engaged in voyages not exceeding 100 miles between the ports of refuge and 20 miles from the land, if by stability they are referred to ships of Category II and are provided with prescribed radio installation;

3) Ships navigating in Azov Sea and in the northern part of the Caspian Sea northwards the line connecting the Cape Tyub-Karagan and Tchetchen Island.

D. Ships of Category IV — of roadstead navigating area:

1) Ships navigating in the port waters with exit to open road, the boundaries of which are established by the Master of the port according to local conditions, season, availability of observation posts and rescue ships.

CHAPTER III

Life-saving appliances

§ 10. Life-saving appliances are sibdivided into life-saving appliances for collective use and life-saving appliances for individual use.

The life-saving appliances for collective use are: lifeboats, inflatable liferafts, heavy liferafts and buoyant apparatus.

The life-saving appliances for individual use are: lifebuoys, life hydrosuits and lifejackets of different kinds.

§ 11. Lifeboats of Class I are the main life-saving appliances and are subject to compulsory carriage on ships of all designations and categories except small ships specified in Chapter IV.

Every lifeboat of Class I shall be an open boat constructed with rigid sides and internal buoyancy only.

The hull of the lifeboat may be made of wood, steel, light alloys and other approved materials.

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[1] The Arctic Seas are: the Barents, White, Kara, Laptev, East-Siberian and Chuckchee Seas; the Far East Seas are: the Bering, Okhotsk and Japan Seas; the boundaries of seas — see Appendix I.

b) The ships of Category II navigating in the Arctic and the Far East Seas, except the Japan Sea are considered as ships of Category I. Other categories of these ships remain unaltered.

According to the type of propelling agent the lifeboats may be row boats or screw boats; according to the type of propulsion — motor boats or boats with manual or pedal operated gear.

1. The carrying capacity of lifeboats is determined according to their gross capacity in cubic metres at a rate not less than 0.283 m^3 per person.

The final carrying capacity of lifeboats is determined by means of test for convenient arrangement of adult persons who having their life-jackets on shall not interfere with the use of the oars and the governing of the boat.

2. The lifeboats of Class I capable of accommodating more than 60 persons shall be of screw type.

3. The screw lifeboats shall be Class A or Class B motor boats or lifeboats with manual or pedal operated gear (See Appendix 2).

4. The carrying capacity of the screw lifeboats is determined at a rate of at least 0.283 m^3 net capacity per person for the motor boats and that of gross capacity for the boats with manual and pedal operated gear.

The final carrying capacity of the screw lifeboats is determined by means of test for arrangement of adult persons who having their life-jackets on shall not interfere with the operating of the motor or the manual or pedal propelling gear as well as the governing of the boat.

§ 12. Lifeboats of Class I (lightened) shall be row wood boats capable to accommodate not more than 30 persons and similar to that of lifeboats of Class I, but more lightened by construction and equipment.

The general requirements for these lifeboats are established by the concerned organizations with approval of the Register.

1. The stowage of lightened lifeboats on a level with lifeboats of Class I is permitted on ships in which the boat deck does not exceed 4.6 m above the lightest sea-going draught.

2. The lifeboats of Class I (lightened) are permitted to be used:

a) in ships of Category III, except passenger, research, training, surveying, rescue ships and tankers;

b) in all ships of Category IV.

§ 13. Lifeboats in sea-going ships of Category I, II, III shall be not less than 7.3 m in length.

When the stowage of the said lifeboats owing to the size of the ship is unreasonable or impracticable, smaller lifeboats, but, not less than 4.9 m in length are permitted to be carried.

Roadstead ships (Category IV) are permitted to carry lifeboats with the least length of 4 m.

The rated length and nominal capacity of the row wood lifeboats of Class I shall conform with those indicated in the following Table.

Table 1

Lifeboats Nos.	0	1	2	3	4	5	6	7	8	9	10	11
Rated length in m	4	4.5	5	5.5	6.0	6.5	7.0	7.5	8.0	7.5	8.5	8.0
Nominal capacity (Number of persons)	10	12	13	16	20	25	30	36	42	46	53	60

Note: Lifeboats Nos. 8 and 11 have different gross cubic capacity.

§ 14. No lifeboat when loaded with full complement of persons and equipment shall weight more than 20 tons.

§ 15. Fishing and sealing boats and motor boats may be reckoned in the life-saving appliances if they have internal buoyancy and are unsinkable (with full load of persons assigned thereto and equipment) when being fully overflowed with water.

Fishing and sealing boats and motor boats are permitted to be substituted for lifeboats:

1) in crab canning and other factory ships and sealing ships of Categories I, II provided the partial replacement of the lifeboats is not in compliance with the carrying capacity of the fishing and sealing boats, but in compliance with the number of persons assigned thereto;

2) in fishing and sealing ships of Category III when they carry at least two lifeboats, one of the two boats may be replaced.

The number of persons which is equal to the difference between the nominal capacity of the lifeboat and the number of persons assigned to the fishing or sealing boat and motor boat shall be provided with inflatable or heavy liferafts;

3) in fishing ships of Category IV — unlimited.

The length of fishing and sealing boats shall be not less than the length of lifeboats indicated in § 13.

§ 16. Service boats, ice-boats and ladders are not referred to life-saving appliances.

Service boats shall be of standard type.

Ice-boats and ladders (for moving of people on weak ice) shall be provided for ice-breakers, ice-strengthened transport ships and sealers. The number of ice-boats and ladders is established by the Shipowner in compliance with conditions of navigation.

§ 17. Liferafts are carried in ships as additional means for partial and, in some cases, for total replacement of lifeboats.

Liferafts may be of inflatable or of heavy type (See Appendix 5) and shall be capable of holding out of water the number of persons they are fit to accommodate.

1. Liferafts of inflatable type shall self-inflate automatically when being dropped into the water and shall protect the occupants against injury from exposure and extremes of temperature.

The rated standard for the floor of inflatable liferafts shall be not less than 0.50 m² per person.

2. Liferafts of heavy (non-inflatable) type shall be equipped in compliance with the requirements of § 22, item 7.

The rated standards per person shall be as follows: the volume of air cases — not less than 0.085 m³; the floor area — not less than 0.372 m². Weight of the raft shall not exceed 180 kg if there is no special arrangement for launching.

§ 18. Buoyant apparatus (lightened rafts and benches) are permitted to be used in ships as additional life-saving appliances and are designed for a short time support of persons who hold on to them when in the water. The unsinkability of the apparatus is provided by air cases or by other equally suitable means.

The minimum rated standards per person shall be:

at the perimeter — 300 mm
lifting power — 14,5 kg

§ 19. Lifebuoys, lifejackets and lifewaistcoats are the life-saving appliances for individual use and are designed for a short time support of persons in water until help arrives.

1. The lifebuoy shall be capable to support in fresh water a load of 14,5 kg during 24 hours.

2. The lifejacket shall comply with the following general requirements:

a) support in fresh water a load of 7,5 kg during 24 hours,

b) impart to the body of a motionless wearer an inclined position,

c) support the head of the wearer when he becomes unconscious in such a position that the face cannot become submerged.

3. The lifewaistcoat shall have lifting power not less than that of a lifejacket and be manufactured according to the manufacturer's specifications approved by the Register.

§ 20. Lifehydrosuits are designed for supporting the persons in water for a long period of time and shall comply with the following general requirements:

1) support in fresh water for 24 hours the wearer and an additional load weighing at least 12 kg in the air;

2) protect the wearer's body against overcooling for at least 12 hours at the water temperature of about 0°C;

3) when dropped overboard, turn the wearer's face upwards and support him in such a position that the face cannot become submerged;

4) be durable, capable of being rapidly and easily put on and not hinder the movements of the wearer when operating, rowing or swimming;

5) to weigh not more than 8 kg and be provided with ventilation.

§ 21. The weight of one adult person when designing the life-saving appliances is estimated to be 75 kg. Two children under the age of 12 years are counted as one adult person; however, when calculating the number of lifejackets, children shall be provided for equally with adults.

§ 22. General directions to Standards.

1. Lifeboats shall be stowed whenever practicable simmetrically in one tier and shall accommodate on either side the number of persons prescribed by the Standards. The double tier stowage of lifeboats may be allowed only with the approval of the Register.

2. The stowage of lifeboats on decks of different height is admitted only when there are means or arrangements preventing the lifeboats when being launched from higher deck to collide with those stowed underneath.

3. Rafts and apparatus shall be stowed on open decks and be always ready for use from each side of the ship.

4. In ships navigating in Arctic or Far East seas, except the Japan Sea, as well as in the Arctic and Antarctic, the lifeboats with manual or pedal operated gear shall be carried in lieu of the row lifeboats. All lifeboats in these ships shall be provided with protective arrangements preserving the occupants against injury from exposure and extremes of temperature.

5. Buoyant apparatus are not permitted to be carried in ships specified in item 4 and in ships navigating in tropical waters. The buoyant apparatus in such ships shall be replaced by rafts of inflatable or heavy type capable to accommodate the required number of persons.

6. Lifeboats in tankers shall be metal motor boats of Class A or boats with manual or pedal operated gear and be fitted with protective arrangements preserving the occupants against fire.

7. Rafts of heavy type shall be fitted with protective arrangements preserving the occupants from exposure and extremes of temperature, as well as with automatic devices for let go the fastenings of rafts when the ship is sinking.

8. Ships of Categories I and II shall be provided with lifehydrosuits for executing salvage and emergency operations which expose the persons to danger of being washed overboard. For scales of equipment see § 56.

9. Every lifejacket and lifehydrosuit shall be provided with an electric lamp (with sea water cell) and a whistle.

10. The use of lifejackets and waistcoats the buoyancy of which depends on air compartments is not allowed until a special instruction of the Register.

11. The use of kapok for filling the life-saving appliances is prohibited.

Note: Provisions of items 4 and 5 do not apply to tramp ships proceeding into the northern ports of the USSR.

CHAPTER IV

Standards of ship's life-saving appliances for collective use

§ 23. Scales for equipping ships with lifeboats, liferafts and buoyant apparatus are established in compliance with the category of the ship.

§ 24. The equipment for ice-breakers, research, training, hydrographic and cable ships of Categories I, II, III as well as for whaling and herring base-ships, crab and fish canning factory ships and similar ships of Categories I and II is prescribed on the basis of the unsinkability of a ship when any of the compartments is flooded.

Otherwise these ships shall be equipped in compliance with the Standards prescribed for cargo ships of corresponding area of navigation.

The unsinkability of passenger and cargo-passenger ships is determined by the provisions of the International Convention for the Safety of Life at Sea, 1948.

§ 25. Ferries shall be equipped with life-saving appliances according to the Standards prescribed for passenger ships of corresponding category

§ 26. Ships which owing to their service may be attributed to several categories shall be equipped according to the Standards prescribed for ships of a higher category.

§ 27. The carrying capacity of liferafts of inflatable or of heavy type may be reduced owing to corresponding increase of lifeboats carrying capacity.

§ 28. If there is a crew and operating personnel in the ship, the Standards are given in certain cases separately, but the muster list for embarcation into lifeboats shall prescribe that all the persons on board are equally provided with life-saving appliances.

§ 29. The number of persons ensured with life-saving appliances specified in the Tables of this Chapter is expressed in percentage to the total number of persons the ship is specified to carry.

Ships of Category I

§ 30. Passenger ships.

Table 2

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50%	15 %	10 %

1. The number of sets of davits in a passenger ship is established in accordance with her length, as specified in Table 22.

Where the total capacity of lifeboats is not sufficient to accommodate the total number of persons, additional sets of davits with corresponding number of lifeboats attached shall be fitted. Under each set of davits shall be carried one lifeboat.

If it is impossible to fit the required number of sets of davits, the additional lifeboats shall be carried under each or any of the lifeboats attached to davits.

2. If it is impracticable and unreasonable to fit a ship with a number of sets of davits specified in column 2 of Table 22 it is allowed to be fitted in accordance with the scales, specified in column 3 of the same Table.

3. Two boats (one on each side of the ship) of the whole number of lifeboats shall be emergency lifeboats for use in case of fall of a person overboard. These boats shall not be more than 8 m in length; the stowage of any additional boats under them is not allowed.

4. Lifeboats capable to accommodate more than 60 persons shall be Class A or Class B motor lifeboats or lifeboats with manual or pedal operated gear.

5. Where the number of lifeboats carried in a ship is less than 13, one of them shall be a Class A or a Class B motor lifeboat or a lifeboat with manual or pedal operated gear.

6. Where the number of lifeboats carried in a ship is from 13 to 20, two of them shall be screw lifeboats: one — a Class A motor lifeboat and the second may be either a Class A or a Class B motor lifeboat or a lifeboat with manual or pedal operated gear.

7. Where the number of lifeboats carried in a ship is 20 or more, two of them shall be Class A motor lifeboats.

Note: Every ship which carries less than 20 lifeboats, irrespective of availability of the radio equipment in a Class A motor lifeboat (See Appendix 2) shall be provided with a portable emergency radio apparatus. It shall be kept in the chart room of the ship or in any other always accessible place, ready to be moved into a lifeboat.

§ 31. Cargo (self-propelled and non-propelled) rescue ships and tugs.

Table 3

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
100 %	—	—

1. In every cargo self-propelled ship of 1600 tons gross tonnage and over one of the carried lifeboats shall be a Class A or a Class B motor lifeboat or a lifeboat with manual or pedal operated gear.

2. In every rescue ship one of the carried lifeboats shall be a Class A or a Class B motor lifeboat.

§ 32. Tankers.

Table 4

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
100%	—	—

1. Lifeboats in every tanker shall meet the requirements of § 22, item 6.

2. In tankers of 3000 tons gross tonnage and over the number of lifeboats shall be not less than four (two on each side of the ship) stowed dispersely, i. e. two shall be stowed aft and two amidships.

3. One of four and more of screw lifeboats shall be a Class A or a Class B motor lifeboat if the latter is also provided with a Diesel-engine.

Note: Every tanker carrying several motor lifeboats shall be provided with not less than two portable emergency radio apparatus designed for at least one motor lifeboat on each side of the ship.

§ 33. Ice-breakers, research, training, hydrographic, cable and sailing cargo ships.

Table 5

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50 %	15 %	10%

1. In every ice-breaker one of the carried lifeboats shall be a Class A or a Class B motor lifeboat.

2. In every research and training ship the screw boats shall be included in the number of carried lifeboats in compliance with § 30 (4), (5), (6), (7) as it is required for passenger ships.

§ 34. Whale factory ships.

Table 6

Number of persons provided with life-saving appliances	
Lifeboats on each side	Total liferafts of inflatable or heavy type
100 % —crew 50 % —operating personnel	— 25%

1. Additional lifeboats required for the operating personnel shall be carried under additional davits and if it is impracticable the said lifeboats shall be stowed under lifeboats attached to davits.

2. In every ship the screw boats shall be included in the number of lifeboats in compliance with § 30 (4), (5), (6), (7) as it is required for passenger ships.

§ 35. Herring base, crab and fish canning factory and similar ships.

Table 7

Particular conditions	Number of persons provided with life-saving appliances		
	Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
Under conditions of insinkability (§ 24)	50 %	15 %	10 %
Under conditions of sinkability	According to scales for cargo ships, § 31		
When the stowage of lifeboats according to scales for cargo ships is impracticable	50 %	50% on each side	—

1. The said ships shall comply with provisions of § 30 (4), (5), (6), (7) and § 34 (1).

§ 36. Whalers, sealers and fishing trawlers (RT).

Table 8

Length of ship, in m	Number of persons provided with life-saving appliances		
	Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
60 and over	100 %	—	—
from 45 to 60	75 %	25%	—
less than 45	According to scales of § 37	—	—

The Standards for operating personnel, if existent any on board ships, are established as for passenger ships (Table 2).

§ 37. Fishing trawlers of medium size (SRT), seine-boats (RS) and similar fishing and sealing ships.

Table 9

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50%	35 %	15%

1. Every ship of 31—45 m in length shall carry at least two lifeboats, one on each side of the ship.

2. Every ship of less than 31 m in length may be provided, with approval of the Register, with one lifeboat if it is capable to accommodate all persons on board and if fitted with a device for easy launching from each side of the ship.

In addition every ship shall carry liferafts of inflatable or heavy type sufficient to accommodate 100 per cent of persons on board.

§ 38. Carriers (PTS) engaged in whaling, fishing or sealing industries, shall be equipped according to the scales for cargo ships specified in § 31.

Ships of Category II

§ 39. Passenger ships.

Table 10

Particular conditions	Number of persons provided with life-saving appliances		
	Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
—	50 %	7 %	3%
See item 4	25 %	35 %	25 %
See Note a)	Lifeboats, liferafts and buoyant apparatus of sufficient aggregate capacity to accommodate 100 per cent of persons and additional buoyant apparatus capable to accommodate 10 per cent of persons		
See Note b)	40%	20%	10%

1. Passenger ships of Category II shall comply with provisions of § 30 (1—7).

2. Every passenger ship engaged on short international voyages shall be provided with sets of davits in accordance with her length as specified in column 2 of the Table 22. The lifeboats shall provide at least the minimum capacity required by column 4 of Table 22 or the capacity required to provide accommodation for all on board if this is less.

3. If it is impracticable or unreasonable on a ship engaged on short international voyages to place the number of davits required by column 2 of the Table 22, they are permitted to be placed in accordance with the scales of column 3 of the same Table. The total capacity of the lifeboats shall be not less than the minimum capacity required by column 4 or the capacity required to provide for all persons on board if this is less.

4. Every passenger ship not engaged on international voyages, on which it is impossible to place the required number of davits, may carry lifeboats capable to accommodate on each side 25 per cent of the total number of persons on board. In addition to the lifeboats this ship shall carry liferafts of inflatable or heavy type sufficient to accommodate 35 per cent and buoyant apparatus sufficient to accommodate 25 per cent of the total number of persons on board.

5. Every hydrofoil passenger ship navigating between the ports of the USSR of the same sea, shall be provided with inflatable liferafts of sufficient aggregate capacity to accommodate 150% of all persons on board, as well as with lifebuoys and lifejackets required by §§ 54 and 55. The said ships shall be unsinkable (See § 24) and provided with radio equipment for dispatch communication with the nearest ports.

Note to § 39. In exceptional cases the Register may permit any ship engaged on short international and non-international voyages to carry passengers in excess of the lifeboat capacity specified in column 4 of Table 22 and to ply voyages up to 1200 miles, provided that these ships meet the particular requirements relating to Standards of permeability and subdivision factor (Convention 1948, Chapter 2, Rule 1).

a) Ships engaged on short international and non-international voyages (up to 600 miles) shall carry as many lifeboats stowed under davits as possible, liferafts of inflatable or heavy type and buoyant apparatus so that the total number of life-saving appliances on board ship shall be sufficient to accommodate 100 per cent of persons on board.

Every ship shall carry in addition to the above mentioned life-saving appliances buoyant apparatus sufficient to accommodate 10 per cent of the total number of persons on board. Quantitative ratio of lifeboats, liferafts and buoyant apparatus shall be approved by the Register.

b) Every ship, which is permitted to ply a voyage up to 1200 miles shall carry lifeboats on each side to accommodate at least 40 per cent of the total number of persons on board; the capacity of these lifeboats shall be not less than the minimum specified in column 4 of Table 22. Every such ship shall carry in addition to the lifeboats, liferafts of inflatable or heavy type for accommodation of 20 per cent, and buoyant apparatus — of 10 per cent of the total number of persons on board.

§ 40. Cargo (self-propelled and non-propelled), rescue ships and tugs.

Table 1?

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
100 %	—	—

1. Every cargo self-propelled ship of under 31 m in length and every non-propelled ship of 500 t gross tonnage and over may carry lifeboats

capable to accommodate on each side 50 per cent and liferafts affording accommodation for 50 per cent of persons on board.

2. Every cargo self-propelled ship of less than 31 m in length and every non-propelled ship of under 500 t gross tonnage is permitted to carry one lifeboat capable to accommodate 100 per cent of persons on board if there is a device for launching the lifeboat from sach side of the ship. Every such ship shall carry in addition to the lifeboat, liferafts of inflatable or heavy type sufficient for 50 per cent of persons on board.

3. In every rescue ship one of the carried lifeboats shall be a Class A or a Class B motor lifeboat.

4. Every cargo ship of 1600 t gross tonnage and over shall comply with provisions of § 3 (1).

§ 41. Tankers.

Table 12

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
100%	—	—

1. Every tanker of Category II shall comply with provisions of § 32 (1), (2), (3) for ships of Category I.

§ 42. Ice-breakers, research, training, hydrographic, cable and sailing cargo ships.

Table 13

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50%	7 %	3 %

1. Every such ship, except the sailing cargo ships, shall comply with provisions of § 33 (1), (2).

§ 43. Sealers.

Table 14

Length of ship, in m	Number of persons provided with life-saving appliances		
	Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
More than 60	100%	—	—
From 45 to 60	75%	25 %	—
Less than 45	50%	35 %	15%

1. The Standards for operating personnel, if existent any on board ships, are established as for passenger ships of Category I, Table 2.

§ 44. Small fishing trawlers (MRT), seine-boats of medium size (SRS), large fishing boats (BRB) and similar fishing and sealing ships.

Table 15

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50 %	15%	10 %

1. Every ship of under 31 m in length may carry one lifeboat capable to accommodate 100 per cent of persons on board, if there is a device for launching the lifeboat from each side of the ship. Every ship shall carry, in addition to the lifeboats, liferafts of inflatable or heavy type sufficient to accommodate 50 per cent of persons on board.

2. In every ship of under 25 m in length, when it is difficult to stow a lifeboat, it may be, with approval of the Register, replaced by a liferaft or liferafts of inflatable or heavy type sufficient to accommodate 100 per cent of persons on board. Every such ship shall carry in addition to the liferafts replacing the lifeboat, liferafts specified in item I, sufficient for 50 per cent of persons.

§ 45. Carrier (PTS), engaged in whaling, fishing or sealing industries, shall be equipped according to the Standards for cargo ships specified in § 40.

Ships of Category III

§ 46. Passenger, research, training, hydrographic and cable ships.

Table 16

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50%	—	—

1. Where the number of lifeboats carried in a passenger ship is four and over, one of such lifeboats shall be a Class B motor lifeboat or a lifeboat with manual or pedal operated gear.

2. In every ship not engaged on non-international voyages, when it is impossible to stow the required number of lifeboats, they may be replaced by liferafts and buoyant apparatus.

All the life-saving appliances carried on board ship shall be sufficient aggregate capacity to accommodate 100 per cent of persons on board; the number of lifeboats shall be sufficient to accommodate from each side of the ship at least 15 per cent of persons on board and the number of liferafts of inflatable or heavy type shall be sufficient for at least 40 per cent of all persons on board.

3. In every passenger ship and launch engaged on small coastal traffic the liferafts of inflatable or heavy type and buoyant apparatus are allowed to be carried in lieu of lifeboats provided that the life-saving appliances are capable to accommodate 100 per cent of persons on board.

Such ships and launches shall be unsinkable when any one of the ship's compartments is flooded.

Buoyancy of open launches shall be provided by air cases similar to that in lifeboats.

The distance for plying of the passenger ships and launches from the port of refuge and from the land is determined by the Inspections of the

Register depending on season, weather conditions, availability of communication means and coastal rescue posts.

§ 47. Cargo, rescue ships and tugs.

Table 17

Particular conditions	Number of persons provided with life-saving appliances		
	Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
Of 500 t gross tonnage and over and more than 31 m in length	100%	—	—
31 m and under in length	50%	25%	—

1. Every cargo ship and tug of 31 m and under in length may carry one lifeboat capable to accommodate 100 per cent of persons on board and in addition shall carry liferafts of inflatable or heavy type sufficient for 50 per cent of persons on board.

One lifeboat is permitted to be carried in a ship if there is a device for launching the lifeboat from each side of the ship.

2. Every cargo ship of under 25 m in length, plying within 20 miles from the port of refuge, in which it is impossible to stow a lifeboat, may carry liferafts of inflatable or heavy type in lieu of a lifeboat, provided that the liferafts are sufficient to accommodate 125 per cent of persons on board.

3. Cargo ships of 1600 t gross tonnage and over shall comply with provisions of § 31 (1).

§ 48. Tankers.

Table 18

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
100 %	—	—

1. Tankers of 3000 t gross tonnage and over shall comply with requirements of § 32 (2), (3). As regards lifeboats, see § 22 (6).

2. Tankers of under 31 m in length may carry one lifeboat capable to accommodate 100 per cent of persons on board, if there is a device for launching the lifeboat from each side of the ship.

§ 49. Ice-breakers, lightships, pilot, fire, sailing cargo and non-propelled ships.

Table 19

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50 %	—	—

1. Lifeboats carried in every ice-breaker shall be Class I lifeboats; lifeboats carried in other ships may be Class I (lightened), provided that the conditions of § 12 are observed.

2. Pilot motor boats and row crafts with internal buoyancy, carried in lightships and pilot ships may be counted as lifeboats.

3. Every sailing cargo and non-propelled ship is permitted to carry one lifeboat and liferafts of aggregate capacity sufficient to accommodate 100 per cent of persons on board, or, with the approval of the Register may carry only liferafts of inflatable or heavy type sufficient to accommodate 100 per cent of persons on board.

§ 50. Small fishing trawlers (MRT), small seine-boats (MRS), fishing boats of medium and small size (SRB, MRB) and similar fishing and sealing ships.

Table 20

Number of persons provided with life-saving appliances		
Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
50%	—	—

1. Every ship under 31 m in length, in which it is difficult or impossible to stow the required number of lifeboats, is permitted to carry one lifeboat capable to accommodate 100 per cent of persons or one lifeboat capable to accommodate 50 per cent of persons on board and liferafts of inflatable or heavy type sufficient to accommodate the remaining persons on board. Ships carrying one lifeboat shall be provided with a device for launching the lifeboat from each side of the ship.

2. In every ship of under 25 m in length, when it is difficult to stow lifeboats, they may be, on the approval of the Register, replaced by a liferaft or liferafts of inflatable or heavy type provided that they are sufficient to accommodate 125 per cent of persons on board.

§ 51. Carriers (PTS) engaged in whaling, fishing or sealing industries shall be equipped according to the Standards for cargo ships specified in § 47.

Ships of Category IV

§ 52. Standards of life-saving appliances for ships of Category IV are determined by the following Table.

Table 21

No.	Destination of ship	Length of ship, in m	Number of persons provided with life-saving appliances: Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
1	Passenger ships	More than 21	15%	20%	10%
		21 and under	—	—	60%
2	Cargo, rescue, tugs, icebreakers, fire and other ships	More than 21	One or several lifeboats and buoyant apparatus of sufficient aggregate capacity to accommodate 100 per cent of persons on board		
		21 and under, except rescue ships	Liferafts and buoyant apparatus sufficient for 100 per sent of persons on board		

No.	Destination of ship	Length of ship, in m	Number of persons provided with life-saving appliances		
			Lifeboats on each side	Total liferafts of inflatable or heavy type	Total buoyant apparatus
3	Tankers	More than 21	50%	—	—
		21 and under	One lifeboat capable to accommodate 100 per cent of persons on board	—	—
4	Dredgers and dredger pontoons	—	50%	—	—
		If it is impossible to stow the required number of lifeboats	25%	50%	—
5	Floating elevators, cranes, repair ships, etc.	—	One lifeboat	—	10%
6	Carriers (PTS), small fishing boats (MRB) and other small fishing or sealing ships	More than 21	One lifeboat	—	10%
		21 and under	—	100%	—
		12 and under	—	50%	—
7	Floating fishing storehouses, base and factory ships, freezing and other ships, lying at anchor	—	25%	—	—
		On approval of the Register	—	50%	—

1. Lifeboats carried in tankers shall comply with the requirements of § 22 (6).

2. Every ship when carrying only one lifeboat shall be fitted with a device for launching the lifeboat from each side of the ship.

3. Every passenger ship of more than 21 m in length in which it is impossible to stow the required number of lifeboats, is allowed to make a partial substitution of lifeboats by liferafts of inflatable or heavy type.

4. Small ships, with internal buoyancy providing for their unsinkability, do not require to be supplied with life-saving appliances for collective use.

5. Dredgers and dredger pontoons plying between the ports, except ships specified in § 9, section C (3), and operating in the Starait of Kerch, shall be supplied with life-saving appliances according to the Standards for cargo ships of corresponding area of navigation, taking into account the provisions of § 13.

6. Every non-propelled ship and hopper shall carry buoyant apparatus capable to accommodate 100 per cent of persons on board.

CHAPTER V

Number of davits and cubic capacity of lifeboats

§ 53. The minimum number of sets (pairs) of davits on passenger ships of Categories I and II and the minimum cubic capacity of lifeboats for passenger ships of Category II are established by the Table 22 according to the length of the ship.

Table 22

Length of ship, in m, according to the „Tonnage Certificate", from—to	Passenger ships of Categories I, II		Passenger ships of Category II
	Usual number of sets (pairs) of davits	Minimum number of sets (pairs) of davits authorized exceptionally	Minimum capacity of lifeboats in cubic metres
31—37	2	2	11
37—43	2	2	18
43—49	2	2	26
49—53	3	3	33
53—58	3	3	38
58—63	4	4	44
63—67	4	4	50
67—70	5	4	52
70—75	5	4	61
75—78	6	5	68
78—82	6	5	76
82—87	7	5	85
87—91	7	5	94
91—96	8	6	102
96—101	8	6	110
101—107	9	7	122
107—113	9	7	135
113—119	10	7	146
119—125	10	7	157
125—133	12	9	171
133—140	12	9	185
140—149	14	10	202
149—159	14	10	221
159—168	16	12	238
168—177	16	12	—
177—186	18	13	—
186—195	18	13	—
195—204	20	14	—
204—213	20	14	—
213—223	22	15	—
223—232	22	15	—
232—241	24	17	—
241—250	24	17	—
250—261	26	18	—
261—271	26	18	—
271—282	28	19	—
282—293	28	19	—
293—303	30	20	—
303—314	30	20	—

Note: The cubic capacity of the lifeboats in ships of under 31 m and over 168 m in length (column 4) and the number of sets of davits (columns 2,3) in ships of over 314 m in length are established on approval by the Register.

1. The davits in ships of over 46 m in length shall be of the following types:

a) luffing of gravity type for operating lifeboats weighing not more than 4 tons;

b) gravity type for operating lifeboats weighing more than 4 tons.

2. The davits in ships of under 46 m in length may be of any approved type.

3. The set of davits serving two lifeboats may be provided with one set of boat's falls if they are of wire rope.

When the boat's falls are of vegetal rope, every set of davits shall be provided with two sets of boat's falls; one set of boat's falls for each lifeboat.

4. Davits, ropes, blocks and all other gears shall be of such strength that the lifeboats can be safely launched with full complement of persons and equipment, with the ship listed not less than 15 degrees either way.

5. Each set of davits shall be fitted with two life lines with mouses and at least with one side ladder. The life lines and side ladder shall be long enough to effect embarkation into the lifeboats, with the ship at its lightest sea-going draught and listed to at least 15 degrees either way.

CHAPTER VI

Standards of ship's life-saving appliances for individual use

§ 54. The minimum Standards of lifebuoys for ships are fixed by the Table 23.

Table 23

Destination of ship	Category of ship	Length of ship, in m	Minimum number of lifebuoys	Including	
				with self-igniting lights	with life-line
Passenger ships	I, II	Under 61 From 61 to 122 122 to 183 183 to 224 224 and over	8 12 18 24 30	Not under 50%, but not less than 6	Not less than 1 on each side of the ship
	III	Under 61 Over 61	6 8	Not under 50%	
	IV	Under 61 Over 61	4 6		
Research, training and hydrographic ships	I II III	According to the Standards for passenger ships of Categories I, II, III correspondingly			
Cargo ships, ice-breakers, tugs, rescue and cable ships	I	—	8	Not less than 4	Not less than 1 on each side of the ship
	II	—	8		
	III	Under 31 Over 31	4 6	Not less than 2	
	IV	—	4	—	

Destination of ship	Category of ship	Length of ship, in m	Minimum number of lifebuoys	Including	
				with self-igniting lights	with life-line
Non-propelled ships	I, II, III	—	4	2	One on each side of the ship
	IV	—	2	—	
Pilot and fire ships	III	—	4	2	Not less than 1 on each side of the ship
Lightships	III	—	6	2	
Dredgers and dredger pontoons	III, IV	Under 31 Over 31	4 6	Not less than 2	
Floating elevators and cranes	IV	—	3	—	—
Whaling and herring base ships, crab and fish canning factory and similar ships	I	According to the Standards for passenger ships of Category I			
Whalers and sealers, fishing trawlers, seine-boats and similar ships	I	Under 61 Over 61	6 8	Not less than 4	Not less than 1 on each side of the ship
	II	Under 31 Over 31	4 6	Not less than 2	
Small fishing trawlers and seine-boats, fishing boats of medium and small size and similar ships	III	—	4	2	1
Small fishing boats, netlifting ships and other small ships	IV	—	2	—	—
Floating fishing storehouses, freezing and other ships, lying at anchor	IV	Under 31 Over 31	4 6	— —	1 2

Notes: 1. The lights of lifebuoys carried in tankers shall get their light from a storage battery.

2. Carriers engaged in whaling, fishing or sealing industries are supplied as cargo ships of corresponding navigation area.

3. Passenger and cargo ships of Category III engaged on international voyages shall be supplied according fo the scales for corresponding ships of Category II.

§ 55. Lifejackets and lifewaistcoats.

1. Every ship irrespective of the navigation area shall carry lifejackets or lifewaistcoats sufficient for every person on board.

2. Every passenger ship shall carry additional lifejackets or lifewaist-

coats suitable for children, i. e. 10 per cent of the total number of lifejackets or lifewaistcoats.

§ 56. Lifehydrosuits carried in the ships of Categories I, II (§ 22, 8) shall provide:

a) in passenger ships — the crew of one emergency lifeboat;

b) in cargo, fishing and sealing ships — one sea watch of the deck crew.

CHAPTER VII

Standards of equipment carried in lifeboats and liferafts

§ 57. All items of equipment specified in §§ 60—72 shall be stowed in lifeboats and liferafts before the ship puts to sea and kept in their places during the whole voyage. These items shall be so stowed and lashed as not to interfere with lodging of persons and can be easily accessible.

§ 58. Every ship of Categories I, II shall carry two hermetic lockers. Each locker shall contain:

a) general charts of navigating area;
b) small protractor;
c) parallel ruler about 300 mm in length;
d) 1 divider;
e) 2 sharp pencils.

The locker containing navigating equipment shall be kept in lifeboats on each side of the ship to which the master or chief officer are assigned.

§ 59. The lifeboats carried in ships of Categories I, II are recommended to be provided with approved chemical de-salting apparatus for the ocean and sea water. The quantity of drinking water is not permitted to be reduced.

The provision of the lifeboats in ships of Category III and liferafts of inflatable or heavy type in ships of Categories I, II and III with de-salting apparatus shall be compulsory (See Tables 26, 30, 31).

§ 60. The equipment of every row lifeboat carried in ships of Category I consists of items specified in the following Table.

Table 24

No.	Items of equipment	Quantity
1	Single banked oars Spare oars	1 set 2
2	Sculling steering oar with a cringle of the wire rope	1
3	Crutches attached to the boat by lanyards or chains	1,5 set
4	Rudder with a rudder pendant and a tiller	1 set
5	Drain bottom plugs (if there are no automatic valves) attached to the boat by lanyards or chains	2 plugs for each hole
6	A mast with yard, rigging and orange coloured sails (See Note 1)	1 set
7	Sail bag	1
8	Boat's compass with lighting (See Note 2)	1 set
9	Sea anchor with a grapnel rope and tripping line	1 set
10	Vegetal or fish oil contained in a galvanized can	4,5 lit.
11	Canvas bag for oil of 4,5 litres capacity with a plug and lanyard (See Note 3)	1
12	A manual pump with two hoses	1 set

No.	Items of equipment	Quantity
13	Galvanized buckets with lanyards	2
14	A bailer for bailing the water out	1
15	Hatchets attached by lanyard, one at each end of the lifeboat	2
16	A jack-knife fitted with a spike and with a tin opener, attached to the boat with a lanyard	1
17	Boat hook	1
18	A lifeline with floats, becketed under the gunwale round the outside of the lifeboat	1
19	Grab lines secured from gunwale to gunwale under the keel (See Note 4)	2
20	Manilla life lines, each of 15 m in length	2
21	Manilla bow painters of 30 and 37 metres in length (See Note 5)	2
22	A boat's lamp with a cistern containing oil sufficient for 12 hours	1
23	Matches not extinguished by wind in watertight, easily opened boxes	2 boxes
24	Waterproof signal flashing electric torch with two spare sets of batteries and two spare bulbs	1 set
25	Signalling mirror (heliograph) for giving light signals in sunny weather	1
26	Parachute rockets emitting a bright red light at a great height	2
27	False fires emitting a bright red light	6
28	Buoyant smoke boxes emitting an orange-coloured smoke	2
29	Sound signal means of approved type (gong, horn, etc.) with a range of audibility of at least 0.5 mile	1
30	Dry foods packed in watertight containers (See Note 6)	1 kg per person
31	Sweetened condensed milk in hermetic containers	0.5 kg per person
32	Drinking water in small casks, cisterns, cans or other approved vessels (See Note 7)	3 lit. per person
33	Dipper with a chain for distributing the water	1
34	Watertight lockers suitable for the stowage of small items of equipment	According to need
35	A first aid outfit No. 1 contained in a watertight packing (See Appendix 4)	1 set
36	Boat's cover, if it does not serve as a protective arrangement prescribed by § 22 (4).	1

Notes: 1. No. 6. Are recommended: a) Light telescopic or component masts; b) Sails made of approved modern light material. The shrouds shall be of galvanized rope.

2. No. 8. A boat's compass with luminized card and lubber line is permitted to be used.

3. No. 11. The canvas bag shall be so constructed that it can be attached to the sea anchor and that the oil can be easily distributed on the water.

4. No. 19. The grab lines and bilge keels or keel rails are intended to enable persons to cling to the lifeboat if upturned.

5. No. 21. One painter is secured constantly on the ring and the other is secured with strop and toggle.

6. No. 30. Biscuits and barley sugar or sweets of sugar and oil are recommended to be provided at a rate of 0.5 kg per person.

7 No. 32. The capacity of one cistern for drinking water shall not exceed 50 litres. A lifeboat shall be provided with at least two cisterns.

8. No. 33. Besides the dipper it is recommended to provide the lifeboat with three transparent plastic glasses (one glass shall be graduated in 10, 20 and 30 grams).

§ 61. The equipment of every row lifeboat carried in ships of Category II shall be the same as that of a lifeboat carried in ships of Category I specified in Table 24, with following amendments.

Table 25

Table 24 No.	Items of equipment	Quantity
10	Vegetal or fish oil contained in a galvanized can	3 lit.
11	Canvas bag for 3 litres of oil, with a plug and lanyard	1
25	Signalling mirror (heliograph)	Not required
30	Dry foods packed in watertight containers	0.5 kg per person
31	Sweetened condensed milk in hermetic containers	0.25 kg per person

§ 62. The equipment of every row lifeboat carried in ships of Category III shall be the same as that of a lifeboat, carried in ships of Category I, with following amendments:

Table 26

Table 24 No.	Items of equipment	Quantity
10	Vegetal or fish oil contained in a galvanized can	3 lit.
11	Canvas bag for 3 litres of oil, with a plug and lanyard	1
12	Manual pump with two hoses	Not required
13	A galvanized bucket with a lanyard	1
15	Hatch attached by lanyard to the boat	1
17	Boat hook	Not required
21	Manilla bow painter of 20 m in length	1
25	Signalling mirror (heliograph)	Not required
28	Buoyant smoke boxes	Not required
30	Dry foods packed in watertight containers	0.25 kg per person
31	Sweetened condensed milk in hermetic containers	0.25 kg per person
32	Drinking water in small casks, cisterns, cans or other approved vessels	1.5 lit. per person
—	Chemical de-salting apparatus for ocean and sea water capable to produce	1.5 lit. per person
35	A first aid outfit No. 2 contained in a watertight packing (See Appendix 4)	1 set
—	A grapnel of about 10 kg in weight with a grapnel rope 50 m in length	1

§ 63. The equipment of every row lifeboat, carried in ships of Category IV consists of items specified in the following Table.

Table 27

No.	Items of equipment	Quantity
1	Single banked oars	1 set
2	Sculling steering oar with a cringle of wire rope	1
3	Crutches attached to the boat by lanyards or chains	1 set
4	Rudder with a rudder pendant and a tiller	1 set
5	Drain bottom plugs (if there are no automatic valves) attached to the boat by lanyards or chains	2 plugs for each hole
6	A galvanized bucket with a lanyard	1
7	A bailer for bailing the water out	1
8	Hatchet attached to the boat by a lanyard	1
9	Manilla bow painter 20 m in length	1
10	A boat's lamp with a cistern containing oil sufficient for 12 hours	1
11	Matches not extinguished by wind, in watertight easily opened boxes	2 boxes
12	False fires emitting a bright-red light	3
13	Sound signal means of approved type (gong, horn, etc.) with a range of audibility of at lest 0.5 mile	1

§ 64. The equipment of every motor lifeboat shall be the same as that of a row lifeboat of corresponding category with following amendments.

Table 28

No.	Items of equipment	Quantity
1	Single banked oars	4
2	Crutches attached to the boat by lanyards or chains	5
	Additional Equipment:	
3	Boat hook (Table 24, No. 17)	1
4	Ladder for boats capable to accommodate more than 60 persons	1
5	Portable fire extinguishers: froth or carbon dioxide	2
6	Spares and tools according to Appendix 3	1 set
	Not required:	
7	A mast with a yard, rigging and orange-coloured sails	1 set
8	Sail bag	1
9	Drain bottom plugs [Table 24(5)] } Where a bilge pump is provided	2 plugs for each hole
10	Manual pump with two hoses } Where a bilge pump is provided	1 set

§ 65. The equipment of every lifeboat with manual or pedal operated gear shall be the same as that of a row lifeboat, with the following amendments:

Table 29

No.	Items of equipment	Quantity
1	Single banked oars	0.5 set
2	Crutches attached to the boat by lanyards or chains	0.5 set and 1 spare
	Additional Equipment:	
3	Boat hook (Table 27, No. 17)	1
4	Ladder for boats capable to accommodate more than 60 persons	1
5	Spares and tools according to Appendix 3	1 set

§ 66. The equipment of every fishing or sealing boat and motor boat counted as lifeboats shall be completed according to the Tables 24—29 and depending on category of ship.

§ 67. The equipment of every liferaft of inflatable type carried in ships of Categories I and II shall consist of items specified in the following Table.

Table 30

No.	Items of equipment	Quantity
1	Cylinder filled with gas for inflating the raft	1 or 2
2	Bellows (in a bag) for pumping air	1
3	Sea anchor	2
4	Rescue quoits with life lines (in lieu of the lifebuoys)	2
5	Telescopic or component oars (paddles)	2
6	Wooden screw plugs for closing up the holes	4
7	Metal clamps with wing-nuts for closing up the holes	6
8	Repair kit: rubber cement, sandpaper, benzine and ready use rubber patches	1 set
9	Watertight cover	1
10	Recognition lights (on the canopy)	2 bulbs
11	Battery to the recognition lights	1
12	Signalling mirror (heliograph) for giving light signals in sunny weather	1
13	False fires emitting a bright red light	6
14	Parachute rockets emitting a bright red light at a high altitude	1
15	Signal-flashing electric torch with a spare bulb and cells sufficient for 20 hours	1 set
16	Matches not extinguished by wind in a watertight packing	2 boxes
17	Pressed sponge for removing water from the floor	2
18	Bailers	2
19	Drinking water contained in hermetically sealed bottles, cans or vessels	1.5 lit. per person
20	Chemical de-salting apparatus for ocean and sea water, capable to produce	1.5 lit. per person

No.	Items of equipment	Quantity
21	Transparent plastic glass for drinking graduated in nine portions per 50 grams	1
22	Victuals: biscuits, barley sugar or sweets of sugar and oil	0.5 kg per person
23	Sweetened condensed milk in hermetic containers	0.25 kg per person
24	A safety-knife fitted with a spike and a tin opener, attached to the raft with a lanyard	1
25	First aid outfit No. 1 contained in an approved watertight packing (For the contents of the first aid outfit, see Appendix 4)	1

Notes: 1. Items specified in Nos. 1—11 belong to the liferafts;
2. Sea anchors and rescue quoits with life lines are attached to the liferafts;
3. Items specified in Nos. 12—25 are the emergency store being packed, except the knife, in a watertight cover.

§ 68. The equipment of every liferaft of inflatable type carried in ships of Category III shall be similar to that specified in Table 30 with the following amendments:

No. 12.— The signalling mirror is not required;

No. 22.— Victuals at a rate of 0.25 kg per person;

No. 25.— First aid outfit No. 2 (For the contents of the first aid outfit, see Appendix 4).

§ 69. The equipment of every lifeboat of inflatable type in ships of Category IV shall be the same as that specified in Table 30, except the items indicated in Nos. 12, 14, 19, 20, 21, 22, 23 and 25.

The false fires (No. 13) shall be 3 in number.

§ 70. The equipment of every liferaft of heavy type in ships of Categories I and II shall consist of items specified in the following Table.

Table 31

No.	Items of equipment	Quantity
1	Telescopic or component oars (paddles)	2
2	Painter of about 50 mm in circumference and 20 m in length	1
3	Sea anchor	1
4	Rescue quoits with life lines	2
5	Signalling mirror (heliograph) for giving signals in sunny weather	1
6	False fires emitting a bright red light	6
7	Parachute rockets emitting a bright red light at a high altitude	2
8	Signal-flashing electric torch with a spare bulb and cells sufficient for 20 hours	1 set
9	Drinking water contained in hermetic vessels	1.5 lit. per person
10	Chemical de-salting apparatus for ocean and sea water, capable to produce:	1 lit. per person
11	Transparent plastic glass graduated in nine portions per 50 grams	1
12	Victuals: biscuits, barley sugar or sweets of sugar and oil	0.5 kg per person
13	Sweetened condensed milk in hermetic containers	0.25 kg per person

No.	Items of equipment	Quantity
14	Safety-knife fitted with a spike and a tin opener attached to the liferaft with a lanyard	1
15	Matches not extinguished by wind in a watertight packing	2 boxes
16	First aid outfit No. 1 contained in an approved watertight packing (See Appendix 4)	1 set

Notes: 1. All the equipment shall be stowed in compartments of the life-rafts and covered by hermetic manholes from each deck.

2. The oars (paddles) and rescue quoits with life lines (Nos. 1 and 4) may be fitted into the side parts of the liferaft.

§ 71. The equipment of every liferaft of heavy type in ships of Category III shall be similar to that specified in Table 31 with the following amendments:

No. 5 — Signalling mirror is not required;
No. 12 — Victuals at a rate of 0.25 kg per person;
No. 16 — First aid outfit No. 2 (See Appendix 4).

§ 72. The equipment of every liferaft of heavy type in ships of Category IV shall consist of items specified in the following Table:

Table 32

No.	Items of equipment	Quantity
1	Telescopic or component oars (paddles)	2
2	Painter of 50 mm in circumference and 20 m in length	1
3	Sea anchor	1
4	False fires emitting a bright red light	3
5	Signal-flashing electric torch with a spare bulb and cells sufficient for 12 hours	1 set
6	Matches not extinguished by wind, contained in a watertight packing	2 boxes
7	Safety-knife fitted with a spike and a tin opener attached to the liferaft by a lanyard	1

CHAPTER VIII

Definitions of the terms for the purposes of the present Standards

1. **Voyage** — navigation of a ship from the moment of leaving a port to the moment of entering a port.

2. **International voyage** — navigation between the home and foreign ports or between the foreign ports only.

3. **Long international voyage** — international voyage of more than 600 miles in length, when the ship is plying over 200 miles from the land.

4. **Short international voyage** — international voyage of less than 600 miles in length, when the ship is plying not more than 200 miles from the land.

5. **Port** (marine) — coastal aquatorium, naturally or artificially protected from rough sea, drift and drifting ice, and coastal zone (territory of port) odjacent thereto, fitted with mooring fittings and arrangements for mooring the ships for load operations.

6. **Open road** — a part of water space in front of the port, not or poorly protected from wind and rough sea and used for anchorage and load operations of the ship.

7. **Port of refuge** — any naturally or artificially protected aquatorium suitable for anchorage of the ships.

8. **Passenger ship** — a ship equipped for carriage of more than 12 passengers and provided with a Passenger Certificate.

9. **Cargo ship** — a ship not provided with a Passenger Certificate, which may carry except cargo and crew not more than 12 outsiders (passengers).

10. **Tanker** — a cargo ship of special construction intended for carriage of liquid cargoes of an inflammable nature in bulk.

11. Ships of fishing industry of the USSR according to their destination:

a) **Whale factory ship** — reception of whales, treatment of the whale raw materials, freezing of meat and liver, transportation of the product;

b) **Herring base ship** — reception of herring, treatment of raw materials and halffinished product (salting and cooling);

c) **Crab canning factory ship** — reception of crabs, canning, supplying and servicing of catchers, transportation of the product;

d) **Fish canning factory ship** — reception of fish, canning, supplying and servicing of the catchers, transportation of the product;

e) **Whaler** — search, slaughter of whales and transportation of them to the factory ship;

f) **Sealer** — search and slaughter of sea animals (seal, eared seal, walrus, etc.), treatment of carcasses and raw leather, cooling and transportation;

g) **Freezing ship** — reception of fresh fish, whale meat and other raw materials, freezing, package and transportation;

h) **Carrier** — reception of fresh fish, cooling and transportation;

i) **Large fishing trawler** (BRT) — fishing with trawl, drift nets or purse seine, salting and freezing of fish, canning, manufacturing of meal and cod-liver oil and transportation;

j) **Fishing trawler of medium size** (SRT) — fishing with trawl, drift nets or purse seine; salting of fish and transportation;

k) **Small fishing trawler** (MRT) — fishing with trawl or drift-nets and transportation;

l) **Seine-boat of large and medium size** (BRS, SRS) — fishing with purse seine, drift nets or trawl and transportation;

m) **Small seine-boat** (MRS) — fishing with purse seine, nets, snurrevod or tiers and transportation;

n) **Fishing boat** (RB) — fishing and catching of sea animals (other than fish) by means of different catching implements, cooling and transportation.

12. **Ship's crew:**— a) master, b) officers, c) hands.

13. **Passenger** — a person who is not a member of the ship's crew and is not employed on business of that ship. A child under the age of one year is not counted as a passenger.

14. **Operating personnel of the fishing or sealing ship** — persons taking part in operation of the ship relating to catching of fish and sea animals (other than fish) and their treatment into the half-finished or final product, as well as the persons servicing machinery, devices and equipment intended for the above said purposes.

15. **Length of a ship** — length according to the "Tonnage Certificate", i. e. "Identical" length. It is measured on the upper deck from the fore side of the stem under the bowsprit to the after side of the stern post: where there is no stern post, the length is to be measured to the fore side of the rudder stock or its vertical prolongation upwards.

16. **Rated length of a boat** — length between the projections of the extreme fore and after points at the outside of the sheathing on the base line, at the height of the lower edge of the gunwale.

17. **1 mile** = 1852 meters.

BOUNDARIES OF THE SEAS, WASHING THE COASTS OF THE USSR

The Barents Sea

Western boundary: from North Cape (Norway) to Cape Bull (Southern Cape of Bear Island) through Bear Island to Cape Sercape (South) in Spitsbergen.

Northern boundary: from Cape Leigh Smith (North East Land) through Stor Island (Great) along the northern coasts of the White and Victoria Islands to Cape Mary Harmsworth (Alexandra Land) and further along the northern edge of Franz Joseph Land to Cape Kohlsaat (Graham Bell Island; $\varphi=81°14'N$).

Eastern boundary: from Cape Kohlsaat to the northeastern end of Novaya Zemlya Island — Cape Zhelanya; along the line of the western entry into the Strait of Matochkin Shar (Cape Serebryanny — Cape Stolbovoi); along the line of the western entry into the Kara Strait (Cape Kusov Noss — western entrance cape in the Gulf Dolgaya), along the line of the western entry into the Yugorskiy Shar (Cape Greben — Cape Belyi Noss).

Southern boundary: along the line: Cape Swiatoi Noss (Murman Coast) — Cape Kanin Noss (Kanin Peninsula).

The White Sea

Northern boundary: along the line Cape Swiatoi Noss (Murman Coast) — Cape Kanin Noss, (Kanin Peninsula).

The Kara Sea

Western boundary: along the line of the eastern entry into the Jugorkiy Shar (Cape Sokoli — Cape Belyi); along the line of the eastern entry into the Kara Strait (Cape Balvanski Noss — Cape Menshikof); along the line of the eastern entry into the Strait of Matochkin Shar; from Cape Zhelanya to Cape Kohlsaat.

Northern boundary: from Cape Kohlsaat to the northern and of Komsomolets Island ($\varphi=81°16'N$, $L=95°40'O^{st}$).

Eastern boundary: along the line of the western entries into the straits of North Land and along the line of the western entry into the Vilkitsky Strait (Cape Neupo-Koeva — Cape Poluostrovnoi) through the Geiberg Islands.

The Laptev Sea

Western boundary: along the line of the eastern entries into the straits of North Land and eastern entry into the Vilkitsky Strait (Cape Vaigatch — Cape Pronchischeva).

Northern boundary: from the point $\varphi=81°16'N$, $L=95°40'O^{st}$ to the point $\varphi=79°N$, $L=139°O^{st}$.

Eastern boundary: from the point $\varphi=79°N$, $L=139°O^{st}$ along this meridian to the northern end of Kotelnoi Island (Cape Anisi), along the line of the western entries into the Sannikova, Eteriken and Dimitry Laptev Straits (Cape Vagina — Cape Swiatoi Noss).

The East-Siberian Sea

Western boundary: from the point $\varphi=79°N$, $L=139°O^{st}$ along this meridian to the northern end of Kotelnoi Island; along the line of the eastern entries into the Sannikova, Eteriken and Dimitry Laptev Straits (Cape Shalaurova — estuary of the Kondratyeva River, $\varphi=72°38'N$, $L=143°44'O^{st}$).

Northern boundary: from the point $\varphi=79°N$, $L=139°O^{st}$ to the meridian 180° in latitude 76° N.

Eastern boundary: from the point $\varphi=76°N$ and $L=180°$ along the meridian 180° to the Wrangel Island; from Cape Blossom (South-western end of the Wrangel Island) to Cape Yakkan on the continent.

The Chuckchee Sea

Western boundary: eastern boundary of the East-Siberian Sea.

Northern boundary: from the point $\varphi=76°N$, $L=180°$ to the point $\varphi=72°N$, $L=156°W$.

Eastern boundary: from the point $\varphi=72°N$, $L=156°W$ to Cape Barrow (Alaska).

Southern boundary: from Cape Unikin (Chukotski Peninsula) to the southern entrance cape in the Shishmareva Bay (Seward Peninsula).

The Bering Sea

Northern boundary: from Cape Kriguigun (Chukotski Peninsula) to Cape York (Seward Peninsula).

Southern boundary: from Cape Kamchatski (Kamchatka Peninsula) through the southern ends of the Commanders and Aleutian Islands to Cape Pankova (Unimak Island).

The Okhotsk Sea

South-western boundary: along the line of the eastern entry into the La Perouse Strait (Cape Aniva — Cape Kamuyi).

North-western boundary: along the southern entry into the Nevelski Strait (Cape Tik — Cape Yuzhny (southern) or Suscheva).

South-eastern boundary: from Cape Lopatka (Kamchatka Peninsula) through the Kuril Islands and the straits between them to Cape Shiretoko (Hokkaido Island).

The Japan Sea

Northern boundary: north-western boundary of the Okhotsk Sea.

Eastern boundary: along the line of the western entry into the La Perouse Strait (Cape Kuznetsova — Nossiapu); along the line of the western entry into the Tsugaru Strait (Cape Surakami — Cape Tappi);

South-western boundary: along the line of the northern entry in Korean Strait (Kolcholcape on the Korea Peninsula — Cape Kawadziri on Honsiu Island).

The Baltic Sea

Boundary with the Little Belt: from Cape Pöls-Huok (Als Island) to Cape Veisnaes-Nacke (Aerö Island).

Boundary with the Great Belt: from Cape Gustav Klint (southern extremity of Langeland Island) to the church in the town of Kappel ($\varphi=54°45'N$, $L=11°01'O^{st}$) on Laaland Island.

Boundary with the Guldborg-Sund: along the line of the southern entry to the strait.

Boundary with the Sund: from the lighthouse Stevns ($\varphi=56°17'N$, $L=12°27'O^{st}$) through the strait to Cape Falsterbo-Udde ($\varphi=55°23'N$, $L=12°49'O^{st}$).

The Gulf of Finland

Western boundary: from Cape Hankoniemi (Hanko Peninsula) to Cape Pissapea through the Osmussar Island.

The Gulf of Riga

Northern and western boundaries: from Cape Pissapea through Muhu Väin Strait to Cape Tahkunanina (Hiiu Maa Island); from Cape Emmaste (south-western part of Hiiu Maa Island) through Söela Väin Strait to Cape Pammana (Saare Maa Island); from Cape Sörve through the Irbe Strait to Cape Ovizi (Lüserort) on the continent.

The Black Sea

South-western boundary: along the line of the northern entry into the Bosporus.

Northern boundary: along the southern entry into the Strait of Kerch (Cape Takil — Cape Panagia).

The Sea of Azov

Southern boundary: along the line of the northern entry into the Strait of Kerch (Cape Achilleon — Cape Khroni).

SCREW LIFEBOATS

1. The engines shall be fitted in the motor lifeboats in accordance with the requirements of the "Rules for construction of sea-going steel ships" and "Rules for fire extinguishing equipment of sea-going ships". The engines shall be capable of being started readily and have a running reliability in cold weather, as well as under conditions of 10 degrees list and 10 degrees trim.

2. The shafting and other moving parts shall be fenced to protect the persons in the lifeboat from injury.

3. Every screw lifeboat shall be capable of going astern.

4. The volume of the air cases of motor lifeboats shall be increased to compensate for the difference between the weight of all installations (engine, radio set, searchlight, etc.) and that of additional persons which the lifeboat could accommodate if the said installations were removed.

5. The volume of the air cases of the lifeboats with manual or pedal operated gear shall be increased to compensate for the weight of the propelling gear.

Class A motor lifeboat

a) The engine shall be of compression ignition type.

b) The lifeboat shall be provided with fuel sufficient for 24 hours continuous operation.

c) The lifeboat (when loaded with its full complement of persons and equipment) shall be capable of going ahead at a speed of at least 6 miles an hour on case at wind strength — 2 and state of sea — 1.

d) The lifeboat in passenger ships shall be provided with radiotelegraph equipment, installed in a room (cabin) large enough to accommodate the apparatus and the person using it, as well as the searchlight.

e) The searchlight shall include a lamp of at least 80 watts and an efficient reflector. The source of power supplying the searchlight shall give an effective illumination of a light-coloured object, having a width of about 18 m at a distance of 180 m for a period of six hours, of which at least three hours — continuously. If the searchlight is supplied from the storage battery of the boat's radio set, the storage battery shall be of sufficient capacity.

Class B motor lifeboat

a) The engine may be either of compression ignition or internal combustion type.

b) The lifeboat shall be provided with fuel sufficient for 12 hours of continuous operation.

c) The Class B motor lifeboat (when loaded with its full complement of persons and equipment) shall be capable of going ahead at a speed of at least 4 miles an hour in case at wind strength — 2 and state of sea — 1.

Lifeboat with manual or pedal gear

a) The manual or pedal operated propelling gear shall be so constructed as to be capable of: 1) being operated by persons untrained in its use; 2) being operated when the lifeboat is flooded.

b) The speed of the lifeboat requires to be regulated only in the initial period of movement of the boat (when loaded with its full complement of persons and equipment) in case at wind strength — 2 and state of sea — 1.

The lifeboat shall be capable of passing at least 150 m in two minutes from "stop" position. The lifeboat when steadily moving shall be capable of passing at least 450 m in four minutes. In both cases the lifeboat must keep to the given course.

Note: The screw lifeboats carried in tankers shall comply with the requirements of § 22 (6).

SPARES AND TOOLS FOR THE SCREW LIFEBOAT SHALL CONSIST OF ITEMS SPECIFIED IN THE FOLLOWING TABLE:

Table 1

No.	Items of equipment	Quantity
1	Valves assembled in sets, ready to be fitted	1 set for each cylinder
2	Fuel nozzles in assembly	1 set for each engine
3	Spark plugs	1 set
4	Carburettors in assembly, ready to be fitted	1
5	Piston rings	1 ring of each type for each cylinder
6	Flange nuts, cones, nipples of each size	1
7	Rubber, metal, reinforced etc. gaskets (depending on the fitted ones)	Complement
8	Bolts with nuts and washers of each size	1
9	Pipe spanner	1
10	Adjustable spanner	1
11	Pliers	1
12	Screw driver	1
13	Chisel	1
14	File (bastard or smooth cut)	1 of each type
15	Locksmith's hammer	1
16	Lubricator with oil	1
17	Can with oil (for lubricating the engine)	1
18	Grease (for filling the screw-type lubricator)	For operation of the engine of the Class A motor lifeboat for 24 hours; of Class B motor lifeboat—for 12 hours

Notes: 1. The mentioned items shall be stowed in the seats of the box fitted with handles for transportation.

2. Spares in Nos. 2, 3 and 4 are taken depending on the type of the boat's engine.

3. The lifeboats with manual or pedal operated gear do not require to be provided with spare parts indicated in Nos. 1, 2, 3, 4, 5, 6 as well as with lubricating oil, specified in Nos. 17, 18.

APPENDIX 4

CONTENTS OF THE FIRST AID OUTFITS FOR LIFEBOATS

Contents of the first aid outfit No. 1

Table 1

No.	Articles	Volume and quantity
1	Ammonia spirit in ampoules: 1 ml. in each ampoule	30 ml.
2	Iodine solution in ampoules: 1 ml. in each ampoule	30 ml.
3	Convallaria and tincture of valerian in equal parts	30 ml.
4	Boric liniment	50 ml.
5	Sticking plaster	1 roll
6	Cloth or rubber plait to stop bleeding	1
7	Absorbent cotton wool: 50 gr in each packet	2 packets
8	Gauze bandage 7×10 cm	3
9	Gauze bandage 7×14 cm	3
10	Individual dressings	10 packets
11	Surgical (safety) pins	10
12	Pyramidon 0.3 Caffeine 0.1 in tablets	20
13	Norsulfasol in tablets: 0.5 in each tablet	15
14	Nautisan or Aeron in tablets	10
15	1% muriatic morphine ampoule syringes	5
16	Aseptic bandages	2
17	Gauze napkins 33×35 in packets; 10 in each packet	2
18	Desinfectant solution against itch: (spirit — 76%; anaesthesine, tannin — each 5.0—100.0	200.0
19	Folding metal splints	4
20	Scissors	1
21	Instructions for use, printed in linen	1

Contents of the first aid outfit No. 2 (Reduced Outfit)

Table 2

1	Ammonia spirit in ampoules: 1 ml. in each ampoule	30 ml.
2	Iodine solution in ampoules: 1 ml. in each ampoule	20 ml.
3	Convallaria and tincture of valerian in equal parts	15 ml.
4	Boric liniment	50 ml.
5	Cloth or rubber plait to stop bleeding	2
6	Gauze bandage	1
7	Aseptic bandages	3
8	1% muriatic morphine ampoule syringes	2
9	Dressings	6
10	Instructions for use, printed on linen	1

Packing and Marking

1. The boat's First Aid Outfits No. 1 and No. 2 shall be packed in metal boxes.
2. The boxes containing the first aid outfit shall be waterproof, effectively tinned, lacquered and shall have seats for standard packing of the medicines.
3. A handle for transporting the box shall be fitted to the lid.
4. A wire shall be soldered to the lid and body of the box to indicate that the contents is complete and intact.
5. The inscription "First Aid Outfit No. 1" or "First Aid Outfit No. 2" shall be marked on the lid of the box, with oil paint.
6. List of contents printed with indelible paint on the linen shall be attached to the outside of the box.

LIFERAFTS OF INFLATABLE AND HEAVY TYPES

1. The liferafts of inflatable type shall comply with the requirements of § 17 and:

a) be of sufficient strength for launching or dropping them the water from the place of stowage, without any damages;

b) have a ladder, painter and a line securely becketed round the outsides of the raft;

c) have sufficient stability, rigidity and elasticity in a seaway;

d) have at least two inflatable compartments each capable of supporting the number of persons which the liferaft is fit to accommodate, if one of the compartments is damaged, or for lack of gas.

e) have separate vital parts, so that the damage of one of them does not affect the other, and can be easily repaired;

f) shall weigh not more than 150 kg when loaded with a full complement of equipment.

2. The general requirements on the liferafts of heavy type are specified in the Standards "Ship's life-saving appliances. General requirements" and in the General Provisions to the Standards (§ 22, 7).

Note: The number of persons accommodated in the liferafts is determined by the test of the leading samples.

APPENDIX 6

Form R—12

(For passenger ships)

UNION OF SOVIET SOCIALIST REPUBLICS

SAFETY CERTIFICATE

For any / a short international voyage

Issued under the provisions of the International Convention for the Safety of Life at Sea 1948

Name of ship	Distinctive number or letters	Port of registry	Gross Tonnage	Particulars of voyages if any sanctioned under Regulation 22 (c) of Chapter III

The Register of shipping of the USSR certifies.

I. That the above-mentioned ship has been duly surveyed in accordance with the provisions of the Convention referred to above.

II. That the survey showed that the ship complied with the requirements of the Regulations annexed to the said Convention as regards:

1) the structure, main and auxiliary boilers and machinery;
2) the watertight subdivision arrangements and details;
3) the following subdivision loadlines:

Subdivision loadlines assigned and marked on the ship's side at amidships (Regulation 10 of Chapter II)	Freeboard	To apply when the spaces in which passengers are carried include the following alternativ spaces
C·1 C·2 C·3		

III. That the life-saving appliances provide for a total number of ________ persons and no more, viz: ________ lifeboats (including ________ motor lifeboats or mechanically propelled lifeboats) capable of accommodating ________ persons, and ________ motor lifeboats fitted with radiotelegraph installation and searchlight (included in the total lifeboats shown above) requiring ________ certificated lifeboatmen;

liferafts capable of accommodating ________ persons;

________ lifebuoys;

________ lifejackets;

IV. That the lifeboats were equipped in accordance with the provisions of the Regulations.

V. That the ship was provided with a line-throwing appliance and lifeboat portable radio apparatus in accordance with the requirements of the Regulations.

VI. That the ship complied with the requirements of the Regulations as regards radiotelegraph installations, viz:

	Requirements of Regulation	Actual provision
Hours of listening by operator		
Number of operators		
Whether auto-alarm fitted		
Whether main installation fitted		
Whether emergency installation fitted		
Whether main and emergency transmitters electrically separated or combined		
Whether direction-finder fitted		
Number of passengers for which certificated		

VII. That the ship complied with the requirements of the Regulations, as regards fire-detecting and fire-extinguishing appliances and was provided with navigation lights and shapes, and means of making sound signals and distress signals, in accordance with the provisions of the Regulations and also the International Collision Regulations.

VIII. That in all other respects the ship complied with the requirements of the Regulations, so far as these requirements apply thereto.

IX. Number of passengers: in cabins . . . . persons
steerage . . . . persons
in emigrant quarters . . . . persons

The total number of passengers allowed for carriage . . persons

This certificate is issued under the authority of the Government of the Union of the Soviet Socialist Republics.

It will remain in force until „____" __________ 196___

Issued at __________ „____" the day of ______ 196___

L. S. Chief of the __________ Inspection.

of the Register of Shipping of the USSR __________

__________ (__________)
Signature Name

ПРИЛОЖЕНИЕ 6

Форма Р—12

(Для пассажирских судов)

СОЮЗ СОВЕТСКИХ СОЦИАЛИСТИЧЕСКИХ РЕСПУБЛИК

СВИДЕТЕЛЬСТВО О БЕЗОПАСНОСТИ

Для любого / короткого заграничного рейса.

Выдано в соответствии с постановлениями Международной Конвенции по охране человеческой жизни на море 1948 г.

Название судна	Позывные сигналы	Порт приписки	Валовая вместимость	Особенности рейса (если таковые имеются) санкционир. на основании Правила 22 (в), главы III

Регистр СССР удостоверяет, что:

I. Вышеуказанное судно было надлежащим образом освидетельствовано в соответствии с постановлениями Конвенции, указанной выше.

II. Освидетельствование показало, что судно отвечает требованиям Правил, приложенных к упомянутой Конвенции в отношении:

1) корпуса, главных и вспомогательных котлов и механизмов,

2) деления судна на водонепроницаемые отсеки, устройств и деталей,

3) следующих подразделений грузовых марок, соответствующих делению судна на водонепроницаемые отсеки.

Грузовые ватерлинии деления судна на отсеки, определенные и нанесенные на борта в средней части судна (Правило 10, главы II)	Надводный борт	Применяется, когда помещения, предназначенные для пассажиров, включают помещения, которые могут быть заняты либо пассажирами, либо грузами
С·1 С·2 С·3		

III. Спасательные средства предусмотрены на общее число ———— человек, а именно:

———— спасательных шлюпок (включая ——— моторных спасательных шлюпок или спасательных шлюпок с механическими приводами), способных вместить ———— человек, и ———— моторных спасательных шлюпок, снабженных радиотелеграфной установкой и прожектором (включенных в общее число спасательных шлюпок, указанных выше), требующих ———— квалифицированных шлюпочных гребцов, имеющих свидетельство;

———— спасательных плотов, вмещающих ———— человек;

———— плавучих приборов, способных поддерживать ———— человек;

———— спасательных кругов;

———— спасательных нагрудников.

IV. Спасательные шлюпки снабжены в соответствии с требованиями Правил.

V. Судно снабжено устройством для выбрасывания спасательного линя и переносной шлюпочной радиоаппаратурой в соответствии с требованиями Правил.

VI. Судно удовлетворяет требованиям Правил в отношении радиотелеграфной установки, а именно:

	Требования согласно Правилам	В действительности установлено
Часы слухового наблюдения радиооператором		
Число радиооператоров		
Установлен ли автоаларм		
Имеется ли главная (навигационная) установка . . .		
Установлена ли аварийная станция		
Являются ли главный и аварийный передатчики комбинированными или электрически-раздельными . . .		
Установлен ли радиопеленгатор		
Число пассажиров, разрешенное свидетельством . . .		

VII. Судно отвечает требованиям Правил в отношении устройств для обнаружения места пожара и тушения пожара и снабжено навигационными огнями, сигнальными знаками, средствами подачи звуковых сигналов и сигналов о бедствии, в соответствии с требованиями этих Правил, а также Международных правил для предупреждения столкновения судов в море.

VIII. Во всех других отношениях судно удовлетворяет требованиям Правил, поскольку эти требования применимы к данному судну.

IX. Количество пассажиров: каютных . . . . . . чел.
палубных . . . . . . чел.
в эмигрантских
помещениях . . . . . чел.

Всего допускается к перевозке . . . . чел.

Настоящее свидетельство выдано от имени Правительства Союза Советских Социалистических Республик.

Оно сохраняет силу до „____" дня____________мес. 196____г.

Выдано г. ____________ „____" дня____________мес. 196____г.

М. П. *Начальник*________________*Инспекции*

Регистра СССР

____
подпись (фамилия)

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APPENDIX 7

Form P—13

(For cargo ships)

UNION OF SOVIET SOCIALIST REPUBLICS

SAFETY EQUIPMENT CERTIFICATE

Issued under the provisions of the International Convention for the Safety of Life at Sea 1948

Name of ship	Distinctive Number of Letters	Port of Registry	Gross Tonnage

The Register of Shipping of the USSR certifies:

I. That the above-mentioned ship has been duly inspected in accordance with the provisions of the Convention referred to above.

II. That the inspection showed that the life-saving appliances provide for a total number of ________ persons and no more, viz:

________ lifeboats on port side capable of accommodating ________ persons,

________ lifeboats on starboard side capable of accommodating ________ persons,

________ motor lifeboats and/or mechanically propelled lifeboats (included in the total lifeboats shown above),

________ lifebuoys,

________ lifejackets.

III. That the lifeboats were equipped in accordance with the provisions of the Regulations annexed to the Convention;

IV. That the ship was provided with a line-throwing apparatus and lifeboat portable radio apparatus in accordance with the provisions of the Regulations;

V. That the inspection showed that the ship complied with the requirements of the said Convention as regards fire-extinguishing appliances and was provided with navigation lights and shapes and means of making sound signals and distress signals in accordance with the provisions of the Regulations and International Collision Regulations;

VI. That in all other respects the ship complied with requirements of the Regulations so far as these requirements apply thereto;

This certificate is issued under the authority of the Government of the Union of Soviet Socialist Republics.

It will remain in force until „____" day of ________ 196

Issued at ________ the ____ day of ________ 196

L. S.

Chief of the ________________ Inspection

of the Register of Shipping of the USSR

ПРИЛОЖЕНИЕ 7

Форма Р—13

(для грузовых судов)

СОЮЗ СОВЕТСКИХ СОЦИАЛИСТИЧЕСКИХ РЕСПУБЛИК

СВИДЕТЕЛЬСТВО О БЕЗОПАСНОСТИ ПО СУДОВОМУ ОБОРУДОВАНИЮ И СНАБЖЕНИЮ

Выдано в соответствии с постановлениями Международной Конвенции по охране человеческой жизни на море 1948 г.

Название судна	Позывные сигналы	Порт приписки	Валовая вместимость

Регистр СССР удостоверяет, что:

I. Вышеозначенное судно было надлежащим образом освидетельствовано в соответствии с постановлениями Конвенции, указанной выше.

II. Освидетельствование показало, что спасательные средства предусмотрены на общее

число ——— человек, а именно:

————— спасательных шлюпок по левому борту судна, вмещающих ————— человек,

————— спасательных шлюпок по правому борту судна, вмещающих ————— человек,

————— моторных спасательных шлюпок или шлюпок с механическими приводами (включенных в общее число спасательных шлюпок, указанных выше),

————— спасательных кругов,

————— спасательных нагрудников.

III. Спасательные шлюпки снабжены в соответствии с требованиями Правил, приложенных к Конвенции;

IV. Судно снабжено устройством для выбрасывания спасательного линя и переносной шлюпочной радиоаппаратурой, в соответствии с требованиями Правил:

V. Освидетельствование показало, что судно удовлетворяет требованиям указанной Конвенции в отношении устройств для тушения пожара и снабжено навигационными огнями, сигнальными знаками, средствами подачи звуковых сигналов бедствия в соответствии с требованиями Правил, а также Международных правил для предупреждения столкновения судов в море;

VI. Во всех других отношениях судно удовлетворяет требованиям Правил, поскольку эти требования применимы к данному судну.

Настоящее свидетельство выдано от имени Правительства Союза Советских Социалистических Республик.

Оно сохраняет силу до „———“ дня————————месяца 196 г.

Выдано в „———“ дня————————месяца 196 г.

М. П.

Начальник——————————————————**Инспекции**

Регистра СССР————————————

APPENDIX 8

Form P—11

UNION OF SOVIET SOCIALIST REPUBLICS

EXEMPTION CERTIFICATE

Issued under the provisions of the International Convention for Safety of Life at Sea 1948

Name of Ship	Distinctive Number or Letters	Port of Registry	Gross Tonnage

The Register of Shipping of USSR certifies that the above-mentioned ship is, under the authority conferred by Regulation ________ of Chapter ________ of the Regulations annexed to the Convention referred to above, exempted from the requirements of* ________________________________
____
Convention on the voyages ________________________________
to ____

(Insert here the condition, if any, on which the exemption certificate is granted.)

This certificate is issued under the authority of the Government of the Union of the Soviet Socialist Republics.

It will remain in force until the ______ day of ________________ 19______

Issued at ________________ the ______ day of ________________ 19______

Chief of the ________________ Inspection

of the Register of Shipping of USSR

* Insert here references to Chapters and Regulations, specifying particular paragraphs.

ПРИЛОЖЕНИЕ 8

Форма Р—11

СОЮЗ СОВЕТСКИХ СОЦИАЛИСТИЧЕСКИХ РЕСПУБЛИК

СВИДЕТЕЛЬСТВО ОБ ИЗЪЯТИИ

Выдано в соответствии с постановлениями Международной Конвенции по охране человеческой жизни на море 1948 г.

Название судна	№ судна или его позывной сигнал	Порт приписки	Валовая вместимость

Регистр Союза ССР удостоверяет, что вышеуказанное судно в соответствии с полномочием, предоставленным Правилом-__________ главы __________ Правил, приложенных к Конвенции, упомянутой выше, освобождается от требований*

____

Конвенции на рейсы ______________________________

до ____

Поместить здесь условия, на основании которых выдано свидетельство об изъятии).

Настоящее свидетельство выдано от имени Правительства Союза Советских Социалистических Республик.

Оно сохраняет силу до______дня____________________мес. 19______г.

Выдано ______________дня____________________мес. 19______г.

*Начальник*____________________*Инспекции*

Регистра СССР

М. П.

---

* Поместить здесь ссылки на главы и правила с указанием отдельных параграфов

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CONTENTS

Регистр Союза СССР

Нормы снабжения спасательными средствами морских и рейдовых судов
Разработаны и подготовлены к изданию ЦПКБ-1 ММФ

Ответственный редактор *Спадони Л. Р.*
Техн. редактор *Л. П. Дрожжина*
Корректор *З. А. Ларибни*

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REGISTER OF SHIPPING OF THE USSR

STANDARDS

OF STABILITY OF SEA-GOING VESSELS AND FLOATING CRANES

PUBLISHING HOUSE "MORSKOI TRANSPORT"
LENINGRAD 1961

Declassified in Part - Sanitized Copy Approved for Release 2012/12/06 : CIA-RDP80T00246A023000360001-6

РЕГИСТР СОЮЗА ССР

НОРМЫ
ОСТОЙЧИВОСТИ МОРСКИХ СУДОВ И ПЛАВУЧИХ КРАНОВ

ИЗДАТЕЛЬСТВО «МОРСКОЙ ТРАНСПОРТ»
ЛЕНИНГРАД 1961

STANDARDS
OF STABILITY OF SEA-GOING VESSELS AND FLOATING CRANES

PUBLISHING HOUSE "MORSKOI TRANSPORT"
LENINGRAD 1961

This English edition of the Standards of Stability of sea-going vessels (part I of this book) is the translation of the Russian edition of the Standards of Stability of sea-going vessels and coasters (of transport and fishing fleets), published in 1959, with the supplement of the "Bulletin of additions and amendments to the Present Standards of Stability of sea-going ships and coasters of transport and fishing fleets (Issue No. 3)" published in Russian in the same year.

Simultaneously in Part II of this edition are given Standards of Stability of Floating Cranes translated from the corresponding Russian edition published in 1960.

Corrections of some minor errata, discovered until the publishing of this edition have also been inserted.

PART I

STANDARDS OF STABILITY OF SEA-GOING VESSELS AND COASTERS (OF TRANSPORT AND FISHING FLEETS)

PREFACE

The Standards of Stability of sea-going vessels and coasters of transport and fishing fleets are worked out on the basis of materials of experimental and theoretical researches as well as on the study of the experience gained in navigation of the merchant ships of the USSR.

When compiling the Standards the casualties of some ships were analysed, the experience of application of "Provisional Standards of Stability for sea-going merchant vessels and coasters" issued by the Register of the USSR in 1948 was taken into account, the scientific, technical and statistic data published in Soviet and foreign press were examined, and the recommendations received from organizations connected with design, building and navigation of ships, as well as from individual specialists, were taken into consideration.

The Standards were drafted by the department of Sea-Going Qualities of the Central Scientific Maritime Research Institute, examined and supplemented by the Standard Department of the Central Designing Office No. 1 of the Ministry of Marine and the Special Commission of the Sea-Going Qualities Section of the Technical Council of the Register of the USSR.

The representatives of the Register of the USSR, the Central Scientific Maritime Research Institute, the Academician Kryloff Institute, the State Design Institute of the Fishing Fleet, the Leningrad Shipbuilding Institute, Shipping Companies, and the Central Designing Office No. 1 of the Ministry of Marine, contributed their share to the work of the Commission.

The main criterion of stability accepted in the Standards takes into account the combined effect on the ship of the wind and rolling, that corresponds closely to the real conditions the ship meets with at sea. Furthermore, the Standards foresee the check of the stability on the basis of additional factors defining the capability of the vessel to withstand the external heeling forces.

The Standards of Stability were approved by the Commission and the Sea-Going Qualities Section of the Technical Council of the Register of Shipping of the USSR for compulsory application in lieu of the "Provisional Standards of Stability of sea-going merchant ships and coasters" issued earlier.

All remarks and proposals to make the "Standards of Stability of sea-going vessels and coasters (transport and fishing fleets)" more exact, should be directed to the Head Office of the Register of Shipping of the USSR, so that they may be taken into account in the subsequent issue.

Director of the Register of Shipping of the USSR

Rykacheff.

INTRODUCTION

These "Standards of Stability of sea-going vessels and coasters (transport and fishing fleets)" apply to all vessels the designing of which began after the date of publication of the corresponding Russian edition, as well as to existing vessels being subject to alterations, modernization or thorough repair after the Standards become effective, if those result in reducing the stability of the vessels.

The Standards may not be applied to ships of under 20 *t* gross tonnage, hydrogliders and hydrofoils.

The stability of the ships at present in service is not to be recomputed according to the Standards if it complies with the "Provisional Standards of Stability of merchant sea-going ships and coasters" issued by the Register of Shipping of the USSR in 1948. The stability of these ships may be recomputed only at the request of the Shipowner.

Approved
by the Deputy Minister of Marine
of the USSR
Orders No. 156,
June 2, 1959 and No. 161, June 4, 1959

CHAPTER I

GENERAL REQUIREMENTS

§ 1. The stability of any ship is considered sufficient provided that: a) the vessel is not capable to capsize under the worst conditions of load distribution from the point of view of stability, when subjected to simultaneous action of dynamically applied wind pressure and rolling, which are determined as indicated further; b) the vessel satisfies the additional requirements stated in Chapter II of these Standards.

§ 2. The stability of a ship with regard to the main criterion K is considered sufficient provided that under the conditions of loading worst from the point of view of stability the dynamically applied heeling moment caused by wind pressure M_{heel} (See § 4—8) is equal to or less than the minimum capsizing moment M_{caps} (See § 11), that is:

$$M_{heel} \leqslant M_{caps},$$

or

$$K = \frac{M_{caps}}{M_{heel}} \geqslant 1{,}00. \qquad (1)$$

§ 3. The verification of stability by means of the criterion indicated in § 2 shall be carried out under all load variants, indicated for different types of vessels in Chapter II "Additional Requirements". For the types of ships not stated in Chapter II among other variants of load distribution being subject to verification, shall be included the following:

1) fully loaded with full stores;
2) fully loaded with 10% of stores;
3) without cargo with full stores;
4) without cargo with 10% of stores.

If in the service of a vessel have been foreseen load variants worse from the point of view of stability than the four above enumerated or than those indicated in Chapter II "Additional Requirements", then under conditions of these load variants the stability of the vessel should be also verified by means of main criterion and additional requirements.

When solid ballast is installed, its weight shall be included in the light weight of the ship.

For ships navigating under winter conditions in winter seasonal zones defined by the Load Line International Convention, besides ordinary load variants, an eventual increase of weight due to icing should be taken into consideration as outlined in § 15. When computing the stability of a ship covered with ice, the divergence of displacement, metacentric height and lateral area due to icing shall be taken into consideration. The stability of a ship covered with ice shall be computed for variant of loading worst from the point of view of stability.

The weight of ice when the stability is verified should not be included into the deadweight of ship and is to be considered as an overload.

In all cases of loading except especially indicated (§ 16, 19, 21) and when necessary, the water ballast may be included into the deadweight of the ship.

§ 4. The heeling moment caused by the action of wind is accepted equal to the product of rated wind pressure by projected lateral area of portion of ship above the waterline and by distance from centre of the projected lateral area to the waterline corresponding to the condition of the ship

$$M_{heel} = .001\ pSz, \qquad (2)$$

where M_{heel} — the heeling moment in tm;
p — the rated wind pressure in kg/m^2;
S — the projected lateral area in m^2 of the portion of a ship above the waterline;
z — the vertical distance in m from the centre of S to the waterline corresponding to the load conditions.

The value of dynamically applied heeling moment is accepted constant for the whole range of subsequent inclinations of the ship.

§ 5. The projected lateral area is considered as an area of projection of the hull of ship above the waterline on a longitudinal section of the ship and should be calculated to the waterline parallel to the design waterline and corresponding to the load conditions of the variant under consideration, in the upright position of the ship.

In the projected lateral area should be included the projection on the longitudinal section of the ship of all surfaces of hull, superstructures and deckhouses as well as projections of masts, fans, boats, deck machinery and all awnings, which may be stretched in stormy weather and projections of side surfaces of deck cargoes including timber cargo, the carriage of which is foreseen by the design.

The projected lateral area of discontinuous surfaces of rails, spars (except masts) and rigging of the ships having no sails and the projected lateral area of other small objects are computed by increasing the total projected lateral area of continuous surfaces by 5% and the static moment of this area by 10%. The projected lateral area of discontinuous surfaces of ships in icing conditions is computed by increasing the total projected lateral area of continuous surfaces and the static moment of this area in icing conditions by 10 and 20% or 7.5 and 15% respectively, depending on the standard of icing (§ 15).

For vessels having auxiliary sails the area of furled sails should be determined separately as a continuous surface from the drawing of the side of a ship and included into the total projected lateral area.

The use of the said approximate methods for determinating the projected lateral area of discontinuous surfaces and small objects, as well as spars and rigging of sailing ships is optional. The computer may determinate these projected lateral areas more strictly. In this case when computing the projected lateral area of discontinuous surfaces, that is: spars and rigging of ships having no sails, rails, crane trusses of lattice type etc. the gabarite areas included shall be multiplied by filling factor the values of which are accepted as follows:

for rails covered with meshed wire	.6
for rails not covered with meshed wire	.2
for cranes of lattice type	.5

The values of filling factor for spars, rigging and shrouds of ships, having no sails are given in Table 1 and in case of icing — in Table 2, depending on the ratio z_0/b, where z_0 is the height of the point of shrouds fastening to the mast above the bulwark; b — the value of extent of the shrouds in way of bulwark.

Table 1

Filling factors

Ratio z_0/b	3	4	5	6	7	8	9	10	11	12	13	14
Filling factor	.14	.18	.23	.27	.31	.35	.40	.44	.48	.52	.57	.61

Table 2

Ratio z_0/b	3	4	5	6	7	8	9	10	11	12	13	14
Filling factor	.27	.34	.44	.51	.59	.66	.76	.84	.91	1.00	1.00	1.00

Projections of the hull above waterline, superstructures and deckhouses should be included with the streamline coefficient — 1.0.

Projections of arrangements with round section (tubes, fans, masts) fitted separately on deck should be included with the streamline coefficient —.6.

The projected lateral areas of small objects, discontinuous surfaces, spars, rigging, rails, shrouds, cordage, etc. when computed in detail, shall be accepted with the streamline coefficient — 1.0.

If the projections of different parts of the lateral area completely or partially overlap one another, then the areas of only one of the overlapping projections shall be included in computation.

Table 3

Dependence of rated wind pressure p in kg/m^2 upon the ship category and upon the height z of the centre of the projected lateral area of portion of ship above the waterline, in metres

Category of ship \ z	.5	1.0	1.5	2.0	2.5	3.0	3.5
I	—	96	107	117	125	131	136
II	—	54	61	66	71	74	77
III	24	27	30	33	35	37	38

(Table 3 continued)

Category of ship \ z	4.0	4.5	5.0	5.5	6.0	6.5	7.0 and more
I	140	144	147	150	153	155	156
II	80	82	84	86	87	88	89
III	39	40	41	42	43	43	44

If the overlapping projections have different streamline coefficients, then the projections with higher streamline coefficient should be included in computation.

§ 6. The arm z of heeling force of the wind pressure is a distance in metres between the centre of the projected lateral area and the waterplane corresponding to the load conditions in smooth water and in upright position of the ship.

The position of the centre of the projected lateral area is determined by method generally used for determining the coordinates of centre of gravity of a plane figure.

§ 7. The rated wind pressure p in kg per square metre of projected lateral area should be taken from the Table 3 in accordance with the category of ship and vertical distance of the centre of the total projected lateral area from the waterline. The direction of wind is accepted perpendicular to the longitudinal section of ship when in upright position. The intermediate values of the rated wind pressure are obtained by linear interpolation.

According to areas and seasons of navigation all ships shall be subdivided into the following three categories:

Category I — ships with gross tonnage not less than 80 *t*, navigating in unrestricted sea and ocean areas.

Category II — ships navigating in restricted sea and ocean areas.

Category III — coastal and estuary trade ships.

Ships navigating in Arctic Seas (Northern Sea Route) are considered as ships of Category I.

Ships of Category III navigating in harbour waters and proceeding to open road are considered as coasters. These ships should not sail more than 20 miles from the port of refuge [1].

Ships of Category II navigating in the Azov and the Black Seas may be allowed to proceed to the Sea of Marmara and to the Aegean Sea as well as to the eastern part of the Mediterranean Sea, eastwards of Cape Matapan.

The ships of Category II navigating in the Baltic Sea may be allowed to proceed through the Straits: Belts, Sound, Kattegat up to the parallel of Cape Skagen as well as through the Kiel Canal down the Elbe up to the exit into the North Sea.

The expansion of the navigation areas of the said ships shall be conformed with the Register of the USSR.

The areas of navigation specified in Table 4 may be reduced by the Register of the USSR depending on local conditions, experience of navigations of similar types of ships, dimensions of ships, stability standards, speed of ship, equipment and provisions, availability of ports of refuge and hydrometeorological stations, which transmit weather and wave forecasts.

When fixing the area of navigation, the name of the prescribed area (sea, gulf, bay, strait, the name of coast limiting the area, etc.) should be indicated.

Extreme dates of navigation should be fixed on the basis of the wind and wave regime characteristics for the given area (Novorossiisk bore, peculiarity of wave formation in the northern part of the Caspian Sea, high percentage of the occurance of storms at the eastern coast of Kamchatka, etc.).

The ship category, established accodring to the Standards of Stability, with icing taken into consideration may be raised if the conditions of ship service exclude the possibility of icing-up.

§ 8. (*a*) The minimum capsizing moment is determined on the basis of either dynamical or statical stability diagrams, taking into consideration the influence of free surfaces of liquid cargoes and rolling of the ship.

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[1] "Port of refuge" — implies an artificially or naturally protected aquatorium which may be used for riding at anchor or for the moorings.

Table 4

Areas of navigation of ships of Categories II and III

No.	Seas and Oceans	Ships of Category II			Ships of Category III		
		Area	Maximum distance of the ship from a port of refuge, in miles	Season	Areas	Maximum distance of the ship from a port of refuge in miles	Season
1	White	Unrestricted	Unrestricted	In all seasons	1) Coastal 2) Southern part of the Sea to the line: Cape Simnegorski-village Tetrino 3) Gulf of Dvina 4) Gulf of Kandalaksha and Gulf of Onega	20 50 50 Unrestricted	Navigational period June—August Navigational period Navigational period
2	Baltic	Unrestricted	Unrestricted	In all seasons	1) Coastal 2) Gulf of Finland to the meridian of Haissaar Island, Gulf of Riga and Muhu-Vajn Strait 3) Southward of the parallel 56° North	20 Unrestricted 50	Navigational period May—August May—August
3	Black	Unrestricted	Unrestricted	In all seasons	1) Coastal 2) To the north—east of the line: Dniestr—Tsaregrad Girlo—Cape Khersones	20 50 Unrestricted	Navigational period June—September May—September
4	Azov	Unrestricted	Unrestricted	In all seasons	1) Coastal 2) All gulfs and firths 3) All basin	20 20 Unrestricted	Navigational period ditto May—September
5	Caspian	Unrestricted	Unrestricted	In all seasons	1) Coastal 2) Northern part of the Sea to the line Chechen Island—Cape Tyub-Karagan 3) Middle and southern parts of the Sea	20 Unrestricted 50	Navigational period May—September June—August

Table 4 continued

No.	Seas and Oceans	Ships of Category II			Ships of Category III		
		Area	Maximum distance of the ship from a port of refuge, in miles	Season	Areas	Maximum distance of the ship from a port of refuge in miles	Season
6	Japanese Sea with Tatarski Strait and Firth of Amur	Unrestricted	Unrestricted	In all seasons	1) Coastal 2) Gulf of Peter the Great 3) Firth of Amur	20 50 Unrestricted	Navigational period May—August Navigational period
7	Barents	Restricted	100 150	In all seasons June—August	1) Coastal 2) Murman Coast 3) Cheshskaia Guba and Gulf of Pechora	20 50 Unrestricted	Navigational period June—August Navigational period
8	Bering with Pacific Coast of USSR	Restricted	100	In all seasons	1) Coastal 2) Eastern Coast of Kamchatka from Cape Lopatka to Cape Kamchatski and Gulf of Anadyr	20 50	Navigational period May—August
9	Okhotsk	Restricted	100 150	In all seasons June—August	1) Coastal 2) Gulf of Sakhalin 3) Penzhina Gulf with Penzhina Guba	20 Unrestricted 50	Navigational period Navigational period June—August
10	Kara, Laptev, East Siberian and Chukchi	Restricted	100	Navigational period depending on ice conditions	1) Coastal	20	Navigational period

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Statical and dynamical stability diagrams shall be plotted by means of one of the methods generally adopted in the ship theory when the ship has a draught corresponding to the calculated design waterline. When using the Tchebysheff Rule at least 9 Tchebysheff ordinates shall be taken.

The drawing scale of the Tchebysheff hull shall be such that the breadth of the ship shall be not less than 250—300 *mm*.

(*b*) By calculating the righting arms of form such superstructures may be taken fully into account which are considered as closed by the "Load Line Rules for sea-going ships" for the purpose of free board estimation, i. e. comply with the requirements of § 68 (*a*), (*b*), (*c*), (*d*); 69, 70, 71 (*a*), (*b*), (*c*) of those Rules (see Appendix 2). In computation of stability the actual length and height of closed superstructures shall be accepted.

If superstructures do not comply with the requirements of § 68 (*d*) of the "Load Line Rules for sea-going ships", i. e. where the Class I and Class II doors in the superstructure bulkheads leading to the continuous deck are the only way out to the deck and thereby the upper coaming edge of the superstructure doors submerges at a heel less than 60°, the height of the superstructures above the continuous deck in the calculation of stability is assumed as one half of its actual height. If the upper coaming edge of the Class I and Class II doors in such superstructures submerges at a heel equal or exceeding 60°, the superstructure may be regarded as closed and its height above the continuous deck in the calculation of stability is assumed equal to the actual one.

For small ships of less than 80 *t* gross tonnage, the superstructures complying with the requirements of § 29 of the "Provisional Freeboard Rules for Small Ships" (Appendix 2) shall be taken into consideration.

(*c*) When calculating the righting arms of form, deckhouses on the upper deck may also be taken into consideration, provided:

1) they have been built in accordance with the Rules of the Register of the USSR;

2) they have watertight doors, the strength of which satisfies the requirements of the 1-st Class closures (Appendix 2);

3) there is an exit to the upper deck.

When all the above enumerated conditions have been fulfilled, the actual height of deckhouses may be included into the computation.

If the strength of the deckhouses complies with the Rules of the Register of the USSR, and the arrangement of the outer doors corresponds to the 1-st Class closure but there is no supplementary exit to the upper deck, such deckhouses, when calculating the righting arms of form, are not taken into consideration at all, but the openings in the deck inside such deckhouses shall be considered closed, whether they have closures or not.

Deckhouses without 1-st Class closures and deck houses the strength of which does not meet the requirements of the Rules of the Register of Shipping of the USSR are not taken into consideration when calculating the righting arms of form. The openings in the deck inside such deckhouses and the companion hatches are considered closed, if their coamings and arrangements for closing satisfy the requirements of § 48 and 51 of the "Load Line Rules for sea-going ships" (Appendix 2).

Separate companion ways into the underdeck spaces are not taken into account when calculating the righting arms of form.

The openings in the metal decks under wooden companion ways are considered as open.

For small ships of less than 80 *t* gross tonnage the openings in deckhouses, decks and superstructures are considered as closed if the arrangements for closing meet the requirements of § 21, 22, 23, 24, 25, 26 of the "Provisional Freeboard Rules for small ships" (Appendix 2). However, the companion ways on upper decks, having folding doors, are considered open in all cases.

Deckhouses on the superstructure decks or deckhouses of the second tier are not taken into account when calculating the righting arms of form, but the openings inside such deckhouses are considered as closed.

(*d*) At the inclination of a ship the beginning of submerging of openings in sides, decks and superstructures which are considered unclosed, will be characterized in the diagram of stability by a step in statical

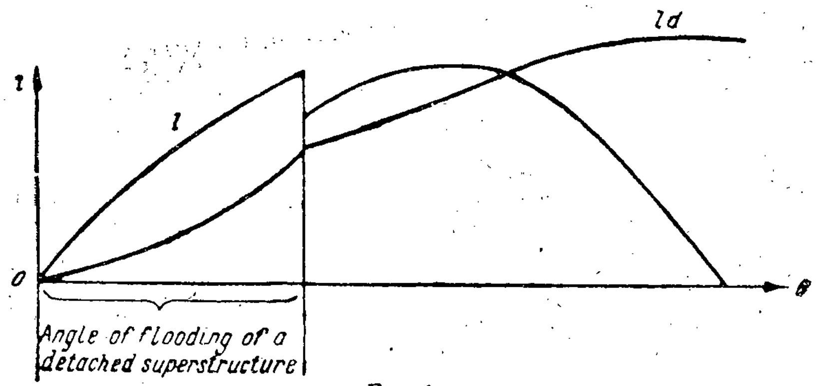

Fig. 1

stability curve or, correspondingly, by a fracture in dynamical stability curve, as shown in Fig. 1 and in further computations the flooded compartments are considered non-existent; or if the ship were sinking due to her being flooded through the openings, the curves cut short at the corresponding angle of inclination (angle of flooding) as indicated in Fig. 2 and the ship is considered to have entirely lost her stability.

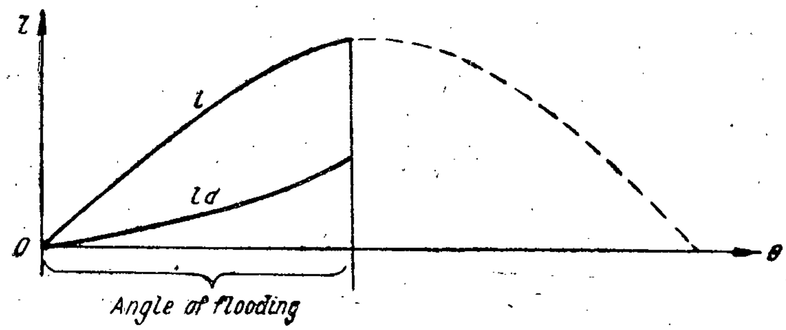

Fig. 2

When calculating the righting arms of form, it is recommended to determine the angle of inclination corresponding to the commencement of flooding through the openings and to plot the curve of the angle of flooding as a function of ship displacement.

Any openings in the upper decks or in the sides of the hull as well as in decks, sides and bulkheads of superstructures are considered unclosed if the closing arrangements do not comply with the requirements of § 40—46, 49, 50, 56, 58, 70—72 of the "Load Line Rules for sea-going ships" and for small ships of less than 80 *t* gross tonnage with the requirements of § 21—26 of the "Provisional Freeboard Rules for Small Ships" (Appendix 2).

The small openings, such as openings for passing wires and ropes of special arrangements, tackles, and deep-water anchors, as well as holes of scupper, discharge or sanitary pipes, which in fact have no influence on the stability at the dynamical heeling, are not to be considered open and the angle of inclination corresponding to their immersion is not to be considered as that of flooding.

(*e*) The tonnage openings in decks, sides or superstructures of the open shelter-deck ships are considered as unclosed and the angle of their immersion is considered as that of flooding.

The spreading of the water got into tweendeck or superstructure through the tonnage opening is limited by the transverse bulkheads nearest to the tonnage opening, and temporary closings in these bulkheads are considered as watertight. The diagrams of stability in this case are similar to those indicated in Fig. 1.

(*f*) To tanks taken into consideration when determining the influence of liquid cargo should be referred the tanks for each kind of liquid cargo and liquid ballast, which can, according to conditions of service, simultaneously be discharged or filled.

Of all combinations of tanks possible in practice should be considered only those, which give the maximum correction to the arm of dynamical stability at the angle of heel equal to 45°.

The tanks which are taken into consideration may be selected in accordance with the Instruction on Loading and Consumption of liquid cargoes.

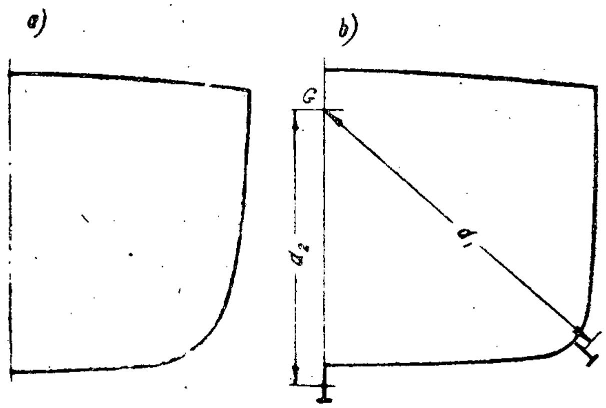

Fig. 3

Tanks giving a correction to the arm of dynamical stability at the heel equal to 45°, which is less than .005 *m*, may be not included into the computation. Tanks giving the correction to the arm of statical stability at the heel equal to 45° and a correction to the initial metacentric radius which are less than .01 *m* and .02 *m* respectively, may also be excluded from the computation.

The correction is calculated for the tanks defined above, filled to 50 per cent of their capacity irrespective to their actual filling. The usual remainder of liquid cargo in empty tanks is not taken into account in computations.

§ 9. (*a*) The rated amplitude of rolling of a round bilge type ship which has no bilge keels (Fig. 3a), is calculated from the formula:

$$\theta_{1m} = X \cdot Y, \tag{3}$$

where θ_{1m} — the amplitude of rolling in degrees;
X and Y — are factors determined as follows.

The factor Y is determined from the Table 5 depending on the category of ship and on the ratio $\frac{\sqrt{r-a}}{B}$, where: $r-a$ — is the initial metacentric height in metres; B — is the breadth of the ship on the design waterline, in metres.

The factor X is calculated from the formula:

$$X = \frac{1}{f_1(u)\sqrt{f_2(u) + \frac{r-a}{B}}}, \tag{4}$$

where u is determined by the expression

$$u = \alpha\left(1 + \frac{1}{6}\frac{B}{T}\right), \qquad (5)$$

here α — is the waterplane coefficient;

T — is the draught of ship in metres, measured from the base line.

The functions $f_1(u)$ and $f_2(u)$ are determined from Table 6 depending on the argument u.

Table 5

The value of factor y for the calculation of the rated amplitudes of rolling

Ratio $\frac{\sqrt{r-a}}{B}$	.03	.04	.05	.06	.07	.08
Category I	26.0	26.0	26.1	26.9	29.0	34.2
Categories II and III	23.8	23.8	23.8	24.2	25.2	27.1

Ratio $\frac{\sqrt{r-a}}{B}$	.09	.10	.11	.12	.13 and more
Category I	42.3	51.1	51.1	51.1	51.1
Categories II and III	30.0	34.6	40.6	50.2	51.1

Table 6

Values of functions $f_1(u)$ and $f_2(u)$ for the calculation of the rated amplitudes of rolling

Functions \ Argument u	.8	.9	1.0	1.1	1.2	1.3
$f_1(u)$	1.69	2.02	2.34	2.68	3.02	3.36
$f_2(u)$	.672	.540	.430	.350	.298	.255

Functions \ Argument u	1.4	1.5	1.6	1.7	1.8
$f_1(u)$	3.74	4.13	4.48	4.91	5.30
$f_2(u)$	.220	.190	.168	.150	.133

(*b*) If the ship has bilge keels, the rated amplitude of rolling is determined from the formula:

$$\theta_{2m} = k\,\theta_{1m}, \qquad (6)$$

where the coefficient K is determined from Table 7 depending on the argument q_1 obtained from the formula:

$$q_1 = \frac{z_g}{T}\,\frac{S_1}{LB}\left(\frac{d_1}{B}\right)^3 \cdot 10^3, \qquad (7)$$

where z_g — the height of the centre of gravity above the base line;

S_1 — the total area of bilge keels;

L — the length of the ship on the design waterline;

d_1 — the distance, measured at the midship section from the longitudinal axis, crossing the centre of gravity of the ship, to the middle of height of the bilge keel (Fig. 3b).

If a ship has only a bar keel, the rated amplitude of rolling is calculated from the formula (6). In this case coefficient k is found from Table 7 depending on the argument q_2, determined from the formula:

$$q_2 = \frac{z_g}{T} \frac{S_2}{LB} \left(\frac{d_2}{B}\right)^3 \cdot 10^3, \qquad (8)$$

where S_2 — the area of the side projection of keel;
d_2 — the size shown on Fig. 3b.

If a ship has a bar keel and bilge keels, the rated amplitude of rolling is calculated from the formula (6) as a function of argument q_3 determined by the equation:

$$q_3 = q_1 + q_2. \qquad (9)$$

Table 7

Values of coefficient k for the computation of the rated amplitudes of rolling of a ship with bilge keels or bar keel

$q_{1,2,3}$	0	1	2	3	4	5	6 and more
k	1.00	.93	.87	.80	.74	.67	.61

(*c*) Amplitude of rolling of ship with sharp bilges (Fig. 4) is assumed to be 70% of that determined from formula (3).

(*d*) If the rated amplitudes of rolling found from formulae (3) or (6) exceed the value of the angle of inclination corresponding to the immersion of the deck edge, the value of the amplitude of rolling should be determined from the formula:

$$\theta_{3m} = \frac{1}{m} \theta_n. \qquad (10)$$

Here m is determined from Table 8 as a function of the ratio $\frac{\theta_n}{\theta_m}$, where θ_n is the angle of inclination corresponding to the immersion of the edge of the upper continuous deck; θ_m is the value of the amplitude of rolling determined from the formulae (3) and (6) depending on whether there are bilge keels or not.

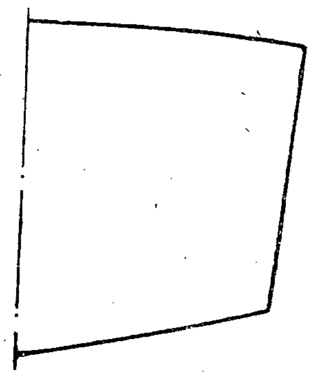

Fig. 4

Table 8

Values of coefficient m for the computation of the rated amplitude of rolling

θ_n/θ_m	.100	.200	.300	.400	.500	.600	.700	.800	.900
$m = \frac{\theta_n}{\theta_{3m}}$	.181	.321	.450	.545	.630	.716	.790	.860	.930

The angle of inclination corresponding to the immersion of the deck edge may be determined from the Tchebysheff's hull or from the formula:

$$\operatorname{tg} \theta_n = 2 \frac{H - T}{B}, \qquad (11)$$

where B is the breadth, T — the draught and H — the moulded depth of the ship to the upper continuous deck.

(*e*) In calculating the amplitude of rolling, the metacentric height of ship is taken without allowance for correction for the free surfaces of liquid cargoes. If the metacentric height is less than .30 *m*, it should be taken when calculating the amplitudes of rolling, equal to $r - a = .30$ *m*.

If the rated amplitudes of rolling found from formulae (3), (6) or (10) are less than 10 degrees, θ_m should be taken equal to 10 degrees irrespective of the results obtained by calculation.

The amplitudes of rolling of ships provided with dampers shall be determined without taking into consideration the effect of dampers.

The values of rated amplitudes of rolling shall be approximated to the whole degrees.

When using the Tables of this paragraph the intermediate values are obtained by linear interpolation.

§ 10. Other methods of calculation with the data of model and full-scale tests attached, may be used for calculating the amplitudes of rolling in lieu of the provisions of § 9.

In this case a detailed computation together with grounds for the estimate of the amplitudes of rolling shall be submitted to the Register of the USSR. This computation shall be carried out on the basis of the following initial assumptions:

1. The amplitudes of rolling should be calculated in relation to conditions of resonance.

2. For ships of Category I with the rolling period in smooth water $\tau \leqslant 8.0$ *sec.* the amplitudes of rolling shall be calculated in relation to a ship which runs alongside the synchronous wave at a speed corresponding to the Froude's number $\frac{v}{\sqrt{gL}} = .1$.

If the rolling period for those ships $\tau > 8.0$ *sec.* the amplitudes of rolling shall be calculated on assumption of resonance when a ship is running at an angle to a wave of 100 *m* in length.

3. For ships of Categories II and III with the rolling period in smooth water $\tau \leqslant 6.2$ *sec* the amplitudes of rolling shall be calculated in relation to a ship which runs at a speed corresponding to the Froude's number $\frac{v}{\sqrt{gL}} = 1$ and alongside the synchronous wave. If the rolling period for these ships $\tau > 6.2$ *sec.* the amplitudes of rolling shall be calculated on assumption of resonance when a ship is running at an angle to the wave of 60 *m* in length.

§ 11. Determination of the minimum capsizing moment, taking into consideration the rolling, may be made on the basis of either dynamical or statical stability diagrams. The diagrams can be of two different types:

1. In the diagram of the first type the curves of statical and dynamical stability are normal or the curve of statical stability has a step and the curve of dynamical stability has a fracture (See Fig. 1). In this case the minimum capsizing moment is determined as follows:

(*a*) When determining the minimum capsizing moment from the diagram of dynamical stability, an auxiliary point A' is to be found prior to the determination. For this purpose the length corresponding to the amplitude of rolling θ_m is set off along the abscissa to the right of the origin of coordinates; the ordinate should be drawn from the point obtained and its intersection with the curve of dynamical stability gives the required point A' (Fig. 5). Then a straight line parallel to abscissa is drawn through point A' and the length $A'A$, equal to the double amplitude of rolling ($A'A = 2\,\theta_m$) is set off along the straigth line to the left of auxiliary point A'. Point A, symmetrical with point A' will be further referred to as initial. A tangent AC is drawn from the initial point A to the curve of dynamical stability and the length AB, equal to one radian (57.3°) is laid off from the point A along the straight line parallel to abscissa. A perpendicular BE is erected from the point B till its intersection with tangent AC in the point E. The portion BE corresponds to the minimum capsizing moment if along the axis of ordinates the work in the accepted scale has been laid off, and to the arm of the minimum capsizing moment

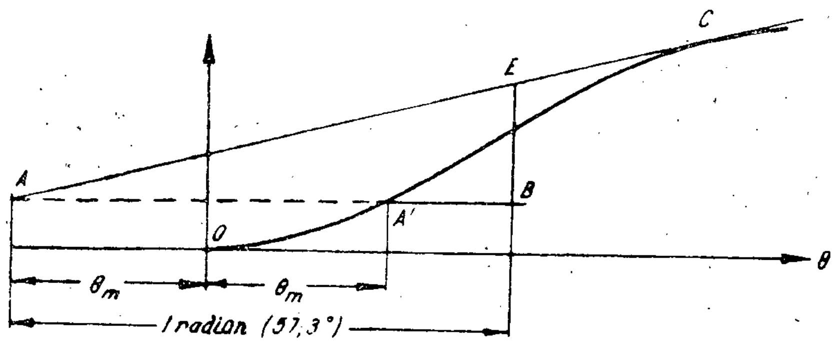

Fig. 5

if along the axis of ordinates the arm in accepted scale has been set off. In the latter case the minimum capsizing moment M_{caps} is determined by multiplying the value of the portion BE, in metres by corresponding displacement D of the ship in tons:

$$M_{caps} = D \cdot \overline{BE}. \qquad (12)$$

(*b*) When the curve of dynamical stability was not drawn, the minimum capsizing moment is to be determined from the diagram of statical stability on the condition of equality of work performed by capsizing and righting moments, taking into consideration the energy of rolling. For this purpose the curve of statical stability is continued into the region of negative abscissa for the length equal to the amplitude of rolling

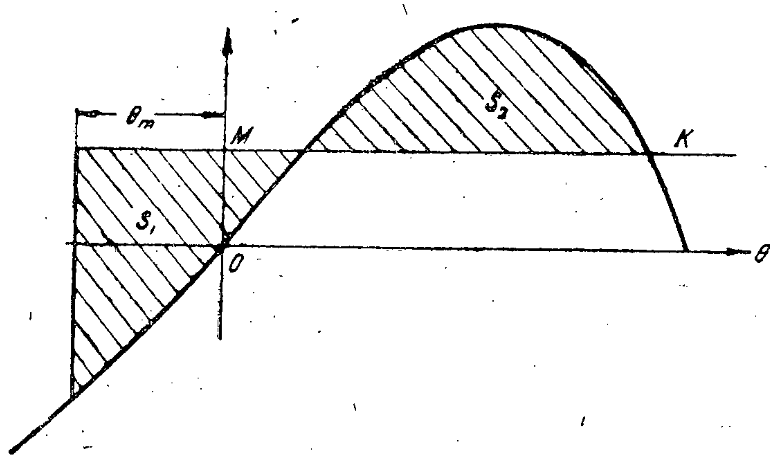

Fig. 6

(Fig. 6) and the straigth line MK parallel to abscissa is selected by means of consecutive approximations until the stripped areas S_1 and S_2 are equalized. The ordinate OM will correspond to minimum capsizing moment, if along the axis of ordinates the work in the accepted scale has been set off, and to the arm of the minimum capsizing moment if along the axis of ordinates the arm in the accepted scale has been set off. In the latter case the minimum capsizing moment is determined by multiplying the value of the portion OM in metres by the corresponding displacement D of the ship in tons:

$$M_{caps} = D \cdot \overline{OM}. \qquad (13)$$

2. In the diagram of the second type the curves of statical and dynamical stability cut short at the angle of inclination corresponding to the angle of flooding (See Fig. 2). The minimum capsizing moment M_{caps} is determined by one of following methods:

(*a*) When the diagram of dynamical stability has been plotted the minimum capsizing moment is determined as follows. The position of the initial point A is found in accordance with the subparagraph 1 (*a*) of this paragraph (See Fig. 5). A tangent is drawn from the initial point A to

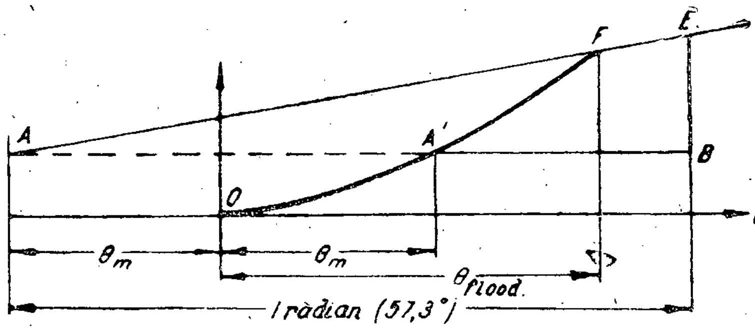

Fig. 7

the curve of dynamical stability, which is possible only when the angle of heeling, corresponding to the tangentical point, is less than the angle of flooding. The determination of the minimum capsizing moment or its arm should be made as shown above in the subparagraph 1 (*a*).

If it is impossible to draw a tangent (Fig. 7) then a straight line is drawn from the initial point A to the point F at which the curve of dynamical stability cuts short. From the same initial point A a straigth

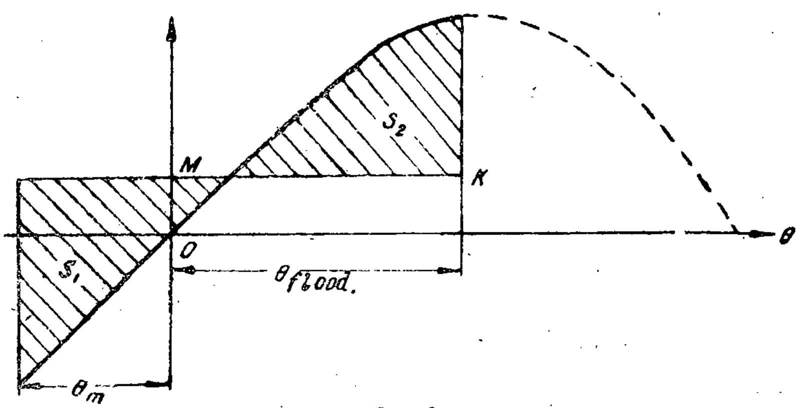

Fig. 8

line parallel to abscissa is drawn and the portion AB equal to one radian (57.3°) is set off along this straigth line. The perpendicular BE is erected from the point B till its intersection with the inclined line AF in point E. The portion BE corresponds to the minimum capsizing moment if along the axis of ordinates the work in the accepted scale is set off, and to the arm of minimum capsizing moment if along the axis of ordinates the arm in accepted scale is set off. In the latter case the minimum capsizing moment is derived from the formula (12).

(*b*) The minimum capsizing moment M_{caps} for the angle of heeling corresponding to the angle of flooding is determined from the diagram of statical stability as follows.

The curve of statical stability is continued into the region of negative abscissa for the length equal to the amplitude of rolling (Fig. 8) and a straight line MK parallel to abscissa is selected by means of consecutive approximations until the stripped areas S_1 and S_2 are equalized. The ordinate OM will correspond to minimum capsizing moment M_{caps} if along the axis of ordinates the work in accepted scale has been set off and to the arm of minimum capsizing moment if along the axis of ordinates the arm in the accepted scale has been set off.

In the latter case the minimum capsizing moment is determined from the formula (13).

CHAPTER II

ADDITIONAL REQUIREMENTS

§ 12. The maximum arm of statical stability at the angle of inclination not less than 30 degrees should be for ships of 100 *m* and downwards in length not less than .25 *m* and for ships exceeding 100 *m* in length not less than .20 *m*.

If the curve of statical stability has two maxima resulting from the effect of superstructures or deckhouses it is necessary that the first maximum should be attained at the angle of heeling not less than 25 degrees (from the upright position).

The region of positive statical stability should extend to the possible greater angle of heeling but not less than 60 degrees.

The curve of statical stability plotted with allowance for icing should have "the curve-set" (point where the ordinate of arm becomes equal to zero) at the angle of heeling not less than 55°, and the maximum arm of statical stability for ships of Categories II and III not less than .20 *m* at the angle of heeling at least 25°.

Ships having ratio $\frac{B}{H} \geqslant 2.5$ may be permitted to navigate when the angle of heeling corresponding to the curve-set is decreased by $\Delta\theta = 10°$ and the angle corresponding to the maximum arm of stability is decreased by $\Delta\theta = 5°$, provided that the reserve of stability computed according to the main criterion respective the category of ship is not less than 1.5. If the ratio $\frac{B}{H}$ is within $2.0 < \frac{B}{H} < 2.5$ and the coefficient of reserve of stability exceeds 1.5, then the allowable decreasing of the angle of heeling corresponding to the curve-set, is determined from the formula:

$$\Delta\theta = 10 \frac{\frac{B}{H} - 2.0}{.5} \text{ degrees}. \qquad (14)$$

But if the coefficient of reserve of stability is within $1.0 < k < 1.5$, then the allowable decreasing of the angle of heeling corresponding to the curve-set may be calculated from the formula:

$$\Delta\theta = 10 \frac{k-1}{.5} \cdot \frac{\frac{B}{H} - 2.0}{.5} \text{ degrees}. \qquad (15)$$

If the values $\frac{B}{H} > 2.5$ and $k < 1.5$, the allowable decreasing is determined from the formula (15), the value $\frac{B}{H}$ being accepted equal to 2.5.

The allowable decreasing of the angle corresponding to the maximum arm of the diagram of statical stability for ships with the said abnormal ratio may be accepted equal to half of the value estimated for the decreasing of the angle of heeling corresponding to the curve-set.

The ship shall satisfy with the said requirement, taking into consideration the influence of free surfaces of the liquid cargoes according to the provisions of § 8 (*f*).

Ships which do not satisfy with the requirements of this paragraph as regards the angle of heeling corresponding to the curve-set due to an abruption of the curve caused by flooding through the openings which are considered as unclosed, may be permitted to navigate only in the regions and seasons prescribed for ships of the second and third Categories depending on the value of wind pressure at which the main criterion is satisfied. However, it is necessary that the rated curve-set of the stability curve determined on the assumption that the openings are watertight, should not be less than prescribed by this paragraph.

§ 13. The stability of ships with tonnage deck openings (shelter-deck ships) which have no ports in the space with the tonnage openings, should be checked for the case of flooding of the said space up to the upper edge of the measurement opening.

The stability of the shelterdeck ships with ports arranged in space below the tonnage opening as well as the ships having a "well" formed by the superstructures on the upper deck and continuous bulwarks provided with ports, should be checked for the case of flooding either of the space having a tonnage opening or of the "well" on upper deck. The quantity of water in the flooded space or "well" and its free surface should correspond to the level of the water up to the lower edge of the ports in the upright position of ship, taking into account the cambering of the ship's deck. When there are two or more "wells" in the ship, the flooding of the greater one shall be checked.

The initial metacentric height computed with due regard to flooding of the said volumes and free surfaces formed thereby shall be positive.

§ 14. The initial metacentric height of all ships, with due regard for free surface of liquids shall be positive in all service conditions

To tanks taken into consideration when determining the influence of liquids should be referred the tanks for each kind of liquids and liquid ballast which have the greatest moment of inertia and can, according to conditions of service, simultaneously be discharged or filled. Of all tanks should be included in computation only those, which give the correction to the initial metacentric radius not less than .01 *m.*

The rated filling of the tanks is accepted in accordance with the provisions of § 8 (*f*).

§ 15. When determining heeling and minimum capsizing moments for ships navigating in winter seasonal zones to north of the latitude 66°30′N and to the south of the latitude 60°00′S as well as in winter in the Barents, Okhotsk Seas and Tatar Strait, the assumed standards for icingup shall be as follows:

(*a*) Weight of ice per square metre of all the exposed weather decks and gangways . . . . . 30 *kg.*

The moment of this loading is determined on basis of heights of the centre of gravity of the corresponding parts of the deck and gangways. The projections of deck machinery, appliances, etc. are included into the deck areas and are not taken into consideration especially;

(*b*) Weight of ice per square metre of projected lateral area of the portion of ship above water line . . . . 15 *kg.*

The projected lateral area is determined in accordance with § 5 of these Standards for the draught corresponding to the load variant, but without taking into consideration the influence of icing-up.

In other areas of the winter seasonal zone the assumed standards of icing-up in winter should be one half of these given in items (*a*) and (*b*).

For ships navigating in the Black and Caspian Seas except the areas indicated in the attached chart (Appendix 3) the weight of ice may be not taken into account.

§ 16. The stability of passenger and passenger-cargo ships shall be checked for the following load conditions:

1. The ship in full load with full stores and full number of class and unberthed passengers with their luggage. The possibility of ballasting with liquid ballast should be approved by the Register of the USSR.
2. The ship in full load and full number of class and unberthed passengers with their luggage, but with 10% of stores.
3. The ship without cargo, but with full stores and full number of class and unberthed passengers with their luggage.
4. The ship as in point 3, but with 10% of stores.
5. The ship without cargo and passengers, but with full stores.
6. The ship as in point 5, but with 10% of stores.
7. The ship as in point 2, but with 50% of stores.

When checking stability by the main criterion, it shall be assumed that class passengers are in their accommodations and unberthed passengers are on decks.

The stowage of cargo in holds, tweendecks and on other decks shall be assumed as for normal service conditions.

The checking of stability, taking into account icing-up, shall be made assuming that no passengers are on exposed weather decks.

§ 17. The initial metacentric height of sea-going passenger ships is to be such, that in case of eventual passenger crowding on one side of the accessible upper decks and as near to bulwark as possible, the angle of statical heeling is not more than one half of the angle at which the flooding through the openings considered unclosed occurs or at which the freeboard deck submerges, or the bilge goes out of the water, depending on the angle whichever is the less and in no case exceeding 10 degrees.

Angle of heeling of passenger and passenger-cargo ships shall be also checked up for stability at the helm circle. In this case the angle of heeling shall not exceed 8 degrees and the total value of heeling caused by the crowding of passengers on one side of promenade decks and by the helm circle shall not exceed the three quarters of the angle at which the flooding occurs through the openings considered unclosed or at which the freeboard deck submerges, or the bilge goes out of the water, depending on the angle whichever is the less, and in no cases shall exceed 12 degrees.

The heeling moment due to helm circle of ship should be determined from the formula:

$$M_{heel} = .233 \frac{D}{g} \frac{v^2}{L} \left(z_g - \frac{T}{2}\right), \qquad (16)$$

where D — displacement of ship in t;
L — length of ship in metres on the load line;
T — draught of ship in m;
z_g — vertical distance in metres of the centre of gravity above the base line;
g — acceleration of the gravity force in m/sec^2;
v — speed of the ship in m/sec at the beginning of the helm circle assumed to be 80% of the full speed.

The checking of the angle of heeling caused by crowding of passengers and helm circle shall be carried out without taking into account the effect of wind and rolling.

When determining the heeling moment caused by crowding of passengers on the promenade deck, it shall be assumed that the conditions of service are normal, taking into account the position of arrangements and equipment, as well as the regulations concerning the access of passengers to various decks. When determining the area where the passengers can crowd, the passages between benches as well as narrow external passages up to .7 *m* wide between the deckhouse and the bulwark or rail are included into the calculations with the coefficient .5.

When determining the angle of heeling caused by passengers crowded on one side of the ship, the weight of one adult person shall be accepted 75 *kg*. The density of crowding of the passengers on deck shall be assumed 6 persons per square metre of the free area of the deck; the centre of gravity of standing persons shall be accepted as 1.1 *m* at the vertical distance above the deck and that of sitting persons at the height of .3 *m* above the seats.

All the calculations of the statical angle of heeling caused by crowding of passengers on one side of the ship and helm circle shall be carried out without taking into account the effect of icing, but with correction for influence of free surfaces of liquid cargo, taking into consideration the of paragraph 14.

§ 18. Intact stability of the passenger and passenger-cargo ships shall be sufficient so that in case of emergency they satisfy with the Rules regulating the subdivision of the sea-going merchant ships.

§ 19. The stability of dry cargo ships shall be checked at the following service conditions:

1) The ship with a draught prescribed by Load Line Rules[1] and homogeneous cargo filling cargo holds, tweendecks, trunks and spaces of cargo hatches and casings, with full stores and fuel, but without liquid ballast.

2) The ship as in point 1, but with 10% of stores and fuel and, if necessary, with liquid ballast.

3) The ship with a draught prescribed by Load Line Rules[1] and homogeneous light cargo (if carriage is specially foreseen) filling cargo holds, tweendecks, trunks and spaces of cargo hatches and casings and also stowed on the upper continuous deck, with full fuel and stores.

4) The ship as in point 3, but with 10% of fuel and stores.

5) The ship without cargo, but with full stores and fuel.

6) The ship as in point 5, but with 10% of fuel and stores.

If, by chance, in the fifth and sixth load variants the Master of the ship uses the cargo holds for additional ballasting with liquid ballast, the stability of the ship with liquid ballast in corresponding holds shall be checked.

For ships carrying in normal conditions of service heavy cargoes stowed on decks, the stability shall be checked under the following variants of loading:

7) The ship with draught prescribed by Load Line Rules [1] with loaded holds and tweendecks and with heavy cargo on decks and full fuel and stores.

8) The ship as in point 7, but with 10% of fuel and stores.

When carrying bulk cargo, the measures prescribed by Rules and Instructions should be taken to prevent the cargo from shifting, and corresponding instractions shall be included into the information on ship stability for Master.

§ 20. The stability of ships carrying timber shall be checked for the following conditions of loading:

1) The ship with timber cargo (with stow volume foreseen) in holds and on deck, with full fuel and stores at the draught prescribed by the Load Line Rules[1].

2) The ship as in point 1, but with 10% of fuel and stores.

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[1] If according to conditions of service the draught of the ship in full load is less than that prescribed by the Load Line Rules, the calculations of stability shall be carried out for the lesser draught.

3) The ship with timber cargo (with the greatest stow volume foreseen) in holds and on decks, with full fuel and stores.

4) The ship as in point 3, but with 10% of fuel and stores.

5) The ship without cargo but with full fuel and stores.

6) The ship as in point 5, but with 10% of fuel and stores.

The stowage of cargo shall comply with the requirements of the "Load Line Rules for sea-going ships" issued by the Register of the USSR as well as with the provisions of the "Information on Ship Stability for the Master".

When computing the righting arms of form at large angles of heeling for timber carrying ships, it is allowed to take into account the volume of deck cargo with its rated height equal to .75 of actual height, but not exceeding the deck of superstructure of the first tier.

When computing the icing-up, the upper surface of the timber deck cargo is considered as if it were a deck and the side surfaces above the bulwark as a part of the projected lateral area of the ship. The Standards of icing accepted for these surfaces shall exceed three times those prescribed by § 15.

If ships carrying timber are used for transportation of other kinds of cargo, the stability of these ships shall be checked in accordance with instructions given in § 19. In this case the computation of righting arms of form of ships usually carrying timber, as well as the computation of their projected lateral area shall be carried out without taking into account the deck timber cargo.

§ 21. The stability of ships carrying liquid cargo in bulk, shall be checked under the following conditions of loading:

1) The ship in full load with full fuel and stores at the draught prescribed by Load Line Rules [1].

2) The ship in full load, but with 10% of fuel and stores.

3) The ship without cargo but with full fuel and stores.

4) The ship as in point 3, but with 10% of fuel and stores.

5) For refuelling tankers the additional load variant should be checked — a ship with 75% of cargo when there are free surfaces of liquids in tanks for each kind of cargo and with 50% of prescribed fuel and stores, without liquid ballast. The effect of the free surfaces shall be taken into account as indicated in § 8 (*f*).

§ 22. The stability of fishing vessels shall be checked under the following load conditions:

1) Going out for fishing with full fuel and stores.

2) Coming back from fishing with full catch in holds and on deck, if the deck cargo is specially foreseen, and with 10% of fuel and stores.

3) Coming back from fishing with 20% of catch in holds or on deck, if the possibility of deck cargo is specially foreseen, with 70% of normal stores of ice and salt and 10% of fuel and stores.

The weight of full catch is determined in the design of the vessel depending on its type, capacity of cargo spaces and stability characteristics. This weight shall correspond to the load line of the vessel and shall be indicated in the check calculations of stability as well as in the "Information on Vessel's Stability for the Master".

Under conditions of service as in points 2 and 3 for vessels fishing with nets, the weight of wet nets on deck shall be included into computation of stability.

The stability under conditions of service shall be checked by means of main criterion under the load conditions indicated in point 4.

4) The vessel at fishing, with open hatches, with catch and wet nets on the deck only, with 25% of fuel and stores and full supply of ice and

[1] See note to paragraph 19.

... nets and catch with derricks, the weight of the load hoisted being equal to the hoisting capacity of the derrick shall be taken into consideration. The weight of the catch on deck shall be foreseen in the design and be included into the "Information on the Vessel's Stability for the Master".

The amplitude of rolling of the vessel as in point 4, shall be accepted 10 degrees and the angle of heel at which the coaming of the cargo hatch submerges, is considered as the angle of flooding through the openings regarded as unclosed. Rated wind pressure for vessels as in point 4 is accepted for vessels of unrestricted service according to norms for the ships of the Second Category: for the vessels of the Second Category according to norms of the Third Category; for the vessels of the Third Category their own norms decreased by 30 per cent are to be taken.

The diagram of statical stability for vessels as in point 4 with the curve cut short at the angle of flooding may not satisfy the requirements of § 12 of the Standards.

§ 23. The stability of tugs should satisfy the general requirements specified in § 1—15 of these Standards under the following load conditions:

1) with full fuel and stores,
2) with 10 per cent of fuel and stores.

The tugs, besides satisfying the general requirements, shall have sufficient reserve of dynamical stability to resist the inclining action of the assumed transverse jerk of the tow rope under the same load conditions, i. e. that the angle of dynamical heel θ_{heel} caused by the assumed jerk of the tow rope is less than the angle of flooding through the openings which are considered as unclosed or the angle of capsizing if the latter is less than that of flooding.

To fulfil this requirement the following condition shall be satisfied:

$$K=\frac{l_{d\,caps}}{l_{d\,heel}}>1.00, \qquad (17)$$

where $l_{d\,caps}$ — the arm of dynamical stability estimated in metres as the ordinate of dynamical stability diagram of the tug at the angle of heel equal to that of flooding through the openings which are considered as unclosed or to the angle of capsizing whichever is the less;

$l_{d\,heel}$ — the dynamical heeling arm in metres defining the action of assumed jerk of the tow rope.

The dynamical heeling arm $l_{d\,heel}$ is determined from the formula:

$$l_{d\,heel}=l_0\left(1+2\frac{T}{B}\right)\frac{b^2}{(1+c^2)\,(1+c^2+b^2)} \qquad (18)$$

or using the nomograph in Fig. 9.

The items being part of the formula (18) are determined as follows:

$2\frac{T}{B}$ — the doubled ratio of the mean draught T of the ship to her breadth which is determined directly;

c — the relative "dynamical" abscissa of the point of suspension of the tow hook which is determined from the formula:

$$c=4.55\frac{X_h}{L}, \qquad (19)$$

where X_h — the longitudinal distance between the point of suspension of the tow hook and the ship's centre of gravity, measured in a horizontal plane in m;

L — the length of the ship in m;

b — the relative "dynamical" ordinate of the point of suspension of the tow hook which is determined by the formula:

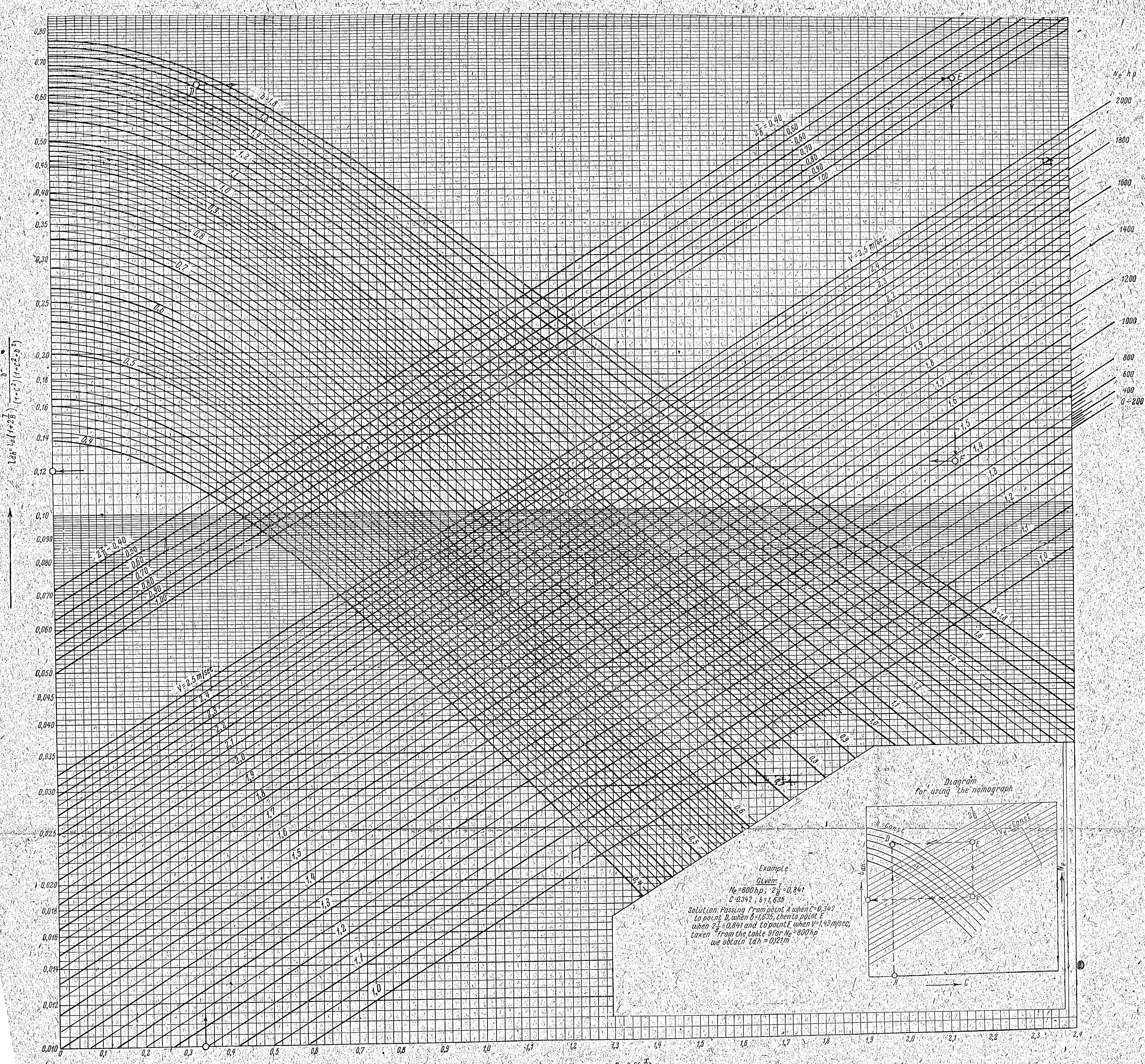

Fig. 9. Nomograph for determining *Rdh*. The nomograph is computed on the basis of the formula (18).

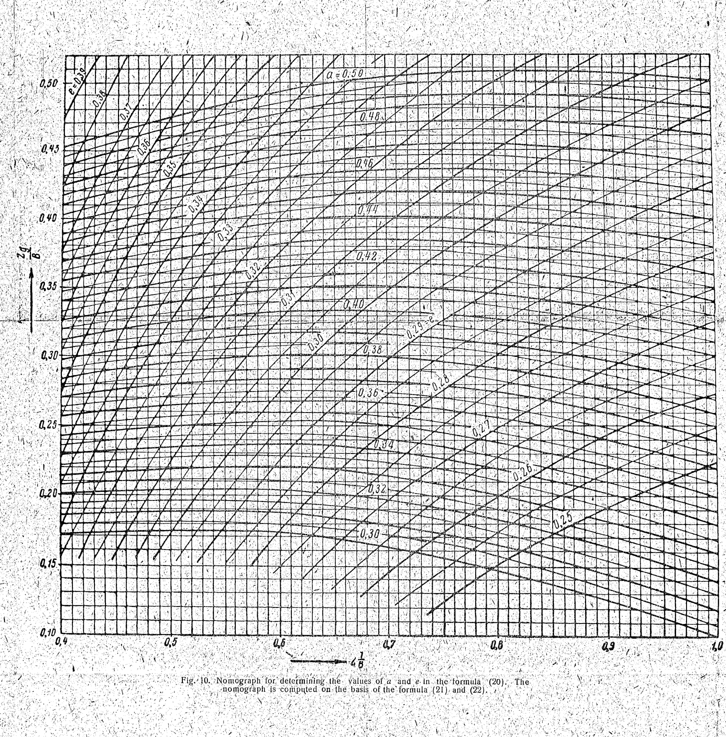

Fig. 10. Nomograph for determining the values of a and e in the formula (20). The nomograph is computed on the basis of the formula (21) and (22).

$$b = \frac{\frac{z_h}{B} - a}{e}, \qquad (20)$$

where z_h — the height of the point of suspension of the tow hook above the base line in m;

while a and e are determined from the formulae:

$$a = \frac{.2 + .3\left(2\frac{T}{B}\right)^2 + \frac{z_g}{B}}{1 + 2\frac{T}{B}}, \qquad (21)$$

$$e = .145 + .2\frac{z_g}{B} + .06\frac{B}{2T} \qquad (22)$$

or by means of the nomograph in Fig. 10,

where z_g — the height of ship's centre of gravity above the base line in m;

$l_0 = \frac{v^2}{2g}$ — the height of the velocity hydraulic pressure head in metres ($g = 9.81$ m/sec^2 — the acceleration of the gravity force) corresponding to the assumed top velocity v of the transverse jerk of tow rope, which is given in Table 9 depending on the shaft power N_e of the ship's main engines.

Table 9

Values l_0 (m) and v (m/sec) as functions of N_e ($h.p.$)

N_e, *h. p.*	0—200	400	600	800	1000	1200	1400	1600	1800	2000
v, *m/sec*	1.30	1.33	1.37	1.43	1.55	1.70	1.88	2.08	2.29	2.50
l_0, *m*	.0862	.0903	.096	.104	.122	.147	.180	.220	.268	.319

Determination of the value $l_{d\,heel}$ by means of nomograph Fig. 9 is made according to the values c, b, $2\frac{T}{B}$ and N_e calculated beforehand, as follows:

1) The point A corresponding to the given value of magnitude c is found on the lower horizontal scale.

2) The point D corresponding to the given value b among the family of curves b=const is plotted on the same vertical line with the point A.

3) The point E corresponding to the given value $2\frac{T}{B}$ among the family of straight lines $2\frac{T}{B}$ =const is found by passing from the point D along the horizontal line.

4) The point E corresponding to the top velocity of the jerk v, preliminarily determined from Table 9 for a given power N_e, is found among the family of curves v=const by passing from the point E along the vertical line. The ordinate of point F read off on the vertical logarithmic scale will be the required value l_{dheel}. The scale N_e, plotted in the right part of the nomograph of Fig. 9 may be used instead of the Table 9 for determining v.

Notes: 1. When checking the stability of a tug for the action of tow rope jerk the angle of flooding through the openings which are regarded as unclosed, is determined on the assumption, that all the doors leading to the engine and boiler casings and to the superstructures on upper deck as well as the doors of all companions to the spaces arranged beneath the upper deck are considered as unclosed irrespective of their construction.

2. The arm of dynamical stability $l_{d\ caps}$ (do not confuse with the arm of the minimum capsizing moment) is determined from the diagram of dynamical stability directly as an ordinate of a point on the curve $l_d=f(\theta)$, which abscissa is equal to the angle of flooding θ_{fl} or to that of capsizing θ_{caps} if the latter is less. The angle of dynamical heel θ_{heel} caused by the assumed jerk of tow rope is also determined from the diagram of dynamical stability directly as an abscissa of a point on the curve $l_d=f(\theta)$ which ordinate is $l_d=l_{d\ heel}$.

3. The stability is checked for the action of the tow rope jerk without taking into account the icing-up and the effect of free surfaces of the liquid cargoes and fuel.

4. When there are special appliances by means of which the centre of effort of the heeling impulse is deemed to be shifted downwards or aft with the tow rope being in athwart direction, the acception of x_h and z_h other than those stated above shall be approved by the Register of the USSR in each separate case.

5. Proper instructions concerning possible cases of service of the ship in the areas where the velocities of water current exceeding 1.3 m/sec are observed, shall be foreseen in the "Information on Vessels Stability for Master".

§ 24. If the ship passes through an area for which the requirements of stability are higher than those provided for normal navigational conditions of a given ship, the stability of the ship, while passing the area should satisfy the requirements prescribed to ships normally navigating in this area.

If the stability cannot be brought to the standard required for ships normally navigating in the area, the passage through the area may be permitted, provided that all necessary measures of precaution were applied, appropriate convoy attached and the stability of the ship corresponds to weather conditions. Irrespective of the above said, the Shipowner should take all possible measures to increase the stability of the ship while passing the area.

§ 25. The value of the positive initial stability of ships in light condition without liquid ballast is not prescribed. Cases of negative stability are to be considered specially and shall be approved by the Register of the USSR.

§ 26. In exceptional cases when the stability of a ship may be considered doubtful, although the requirements of these Standards are satisfied, or when it will be shown that the requirements of the Standards are too stiff, the Register of the USSR has right on his own initiative or at the statement of the designing or exploiting organizations to make amendments to these Standards in relation to the ship concerned.

§ 27. If a ship navigating in an area does not comply with the Standards, the Register of the USSR, in each separate case, may limit navigating area of the ship or make other restrictions depending on the actual standards of stability of the ship, her designation and service conditions.

§ 28. The observance of these Standards does not relieve the Master of responsibility for the stability of the ship in service.

§ 29. For the convenience of supervision of the stability of the ship in service, the Master shall be furnished with "Information on Vessel's Stability for Master", approved by the Register of Shipping of the USSR and including the following.

(*a*) Stability data on typical foreseen load conditions;

(*b*) Instructions concerning the limitations of service, limitations of navigation in severe weather conditions and other measures necessary to secure the safety of the ship against capsizing;

(*c*) Instructions, auxiliary diagrams, tables and other data facilitating the Master an independent evaluation of stability under various load conditions, which were not foreseen;

(*d*) Recommendations to the Master, useful from the viewpoint of improving the stability of the ship.

§ 30. "Information on the Vessel's Stability for Master" shall be complied on the basis of the inclining test of a given ship or a sister ship that was launched previously and determination of the actual ordinate of centre of gravity on the basis of the inclining test.

The inclining test with further calculation of the centre of gravity and stability of the ship shall be carried out for:

(*a*) the first ship of a series under construction;

(*b*) every first ship of the same series constructed at different works and then each fifth ship of the series;

(*c*) all non-serial ships newly built;

(*d*) ships subjected to thorough repair or alteration;

(*e*) all ships, the stability of which is unknown or gives rise to doubt (slow upwrighting, great period of rolling, etc.).

The inclining experiment is recommended to be carried out in accordance with the provisions specified in the "Instruction" attached hereto (Appendix I).

PART II

STANDARDS OF STABILITY OF FLOATING CRANES

PREFACE

The Standards of Stability of floating cranes have been worked out on the basis of experimental and theoretical research results, studies of service experience obtained from operating floating cranes, as well as of published scientific, technical and statistic data, recommendations received from various establishments engaged in design, construction and operation of floating cranes and from a number of experts who have considered the Draft Standards.

The Draft Standards have been worked out by the Central Maritime Scientific Research Institute, supplemented on the basis of comments submitted by the Inspections of the Register of Shipping of the USSR, considered and supplemented by the Special Commission on Stability of the Sea-Going Qualities Section of the Technical Council of the Register of Shipping of the USSR.

The Standards specify a number of requirements defining the ability of a floating crane to withstand the external heeling forces.

The Standards of Stability have been approved by the Sea-Going Qualities Section of the Technical Council of the Register of Shipping of the USSR and have been recommended for adoption as compulsory requirements contributing to safe and efficient operation of floating cranes.

Taking into account the fact that the "Standards of Stability of Floating Cranes" have been worked out and are being issued for the first time, the Register of Shipping of the USSR requests to submit all comments and proposals aimed at making these Standards more precise, to the Head Office of the Register of Shipping of the USSR, so that they might be taken into account in a later edition.

Chief Engineer of the Register of Shipping of the USSR

V. A. Zabrodsky.

INTRODUCTION

The present Standards of Stability apply to all floating cranes the designing of which began after the date of publication of the Russian edition of these Standards.

The Standards of Stability are to be used while considering the stability of the existing floating cranes in case of conversion, modification and overhauling after the date of publication of these Standards, as well as in case of changes in their operating conditions or when doubts arise as to sufficient stability of the cranes; compliance with the present Standards is not obligatory in such cases and the question concerning further use of the floating cranes should be decided by the Register of Shipping of the USSR.

The stability of floating cranes operating in the same regions where they had been used prior to the issue of the present Standards and not submitted to conversion, modification or general overhaul should not be recalculated. The stability of such cranes may be recalculated at the Owner's request only.

The present Standards are not obligatory for floating cranes operating solely in the internal waterways of the USSR.

Approved
by the Deputy Minister of Marine
of the USSR
Order No. 320, December 26, 1959

REQUIREMENTS FOR STABILITY

§ 1. Stability of a floating lifting crane is considered sufficient provided that:

(*a*) the heeling angles of a floating crane in operation, under dynamically applied wind pressure and with load on its hook, do not exceed the permissible values given below;

(*b*) the required reserve of stability of a non-working crane with no load on its hook is ensured under dynamically applied wind pressure which is determined as indicated below.

§ 2. Stability of a working floating crane, that is, with load on its hook, shall be checked for dynamic action of a heeling moment caused by the action of wind. Stability of a crane in operation is considered sufficient if the heeling angle produced by the combined action of load and wind does not exceed the angle at which the freeboard of the floating crane pontoon is equal to 300 *mm* or when the middle of the bilge of midship section frame comes out of the water, whichever is the less and at any rate does not exceed 6°, that is, when the following condition is observed:

$$\theta_d \leqslant \theta_{d\,perm}. \qquad (1)$$

For a crane with its boom fixed in the longitudinal plane the permissible dynamic heeling caused by the action of the wind shall not exceed 3°.

The heeling angle corresponding to the 300 *mm* freeboard of the floating crane pontoon or to the coming of the middle of the bilge out of water is calculated from the following formulae:

$$\operatorname{tg} \theta_{d\,perm} = \frac{2\,(F_{\min} - .30)}{B}$$

or

$$\operatorname{tg} \theta_{d\,perm} = \frac{2\,T_{\otimes}}{B}, \qquad (2)$$

where $F_{\min}$ — is the minimum value of freeboard determined with taking into account the trim of a floating crane and assuming that the crane has no heel (in *m*);

B — breadth of floating crane pontoon;[1]

$T_{\otimes}$ — draught of floating crane pontoon at midsection.

For nonstraight-sided pontoons the above angles of heeling are determined by plotting equi-volume waterlines on the pontoon body drawing.

Stability of floating cranes provided with swinging booms is checked for the maximum load moment and maximum outreach of the boom on board, that is, in the frame plane as well as for the highest position of the boom with due regard to the heeling.

[1] The Standards assign transverse stability of cranes, assuming the pontoon breadth is less than its length. For the cranes with square waterline longitudinal stability should be checked as well.

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The calculated loading condition assumes 10% of stores and fuel as well as a possibility of taking liquid ballast.

The effect of free surfaces of the liquids is taken into account in compliance with the regulations given in § 14 Part I, but the calculation covers only those tanks each of which gives a correction to the initial metacentric radius not less than .1*m*.

The calculated position of the centre of gravity for a load lifted by the crane hook is assumed to be in the point of its suspension to the boom.

§ 3. For a floating crane in operation the dynamically applied heeling moment due to the wind effect is determined from the formula:

$$M_{heel} = .03 \sum k_i S_i z_i \ tm , \tag{3}$$

where k_i, S_i, z_i are as defined in § 6 below and determined considering for the calculation in question the positions of the boom and load on the hook and assuming zero heeling.

For floating cranes with a swinging boom the action of the heeling moment caused by the wind pressure is assumed in the same direction as that of the heeling moment due to the load handled.

§ 4. The dynamic heeling angle θ_d for a floating crane in operation due to the wind effect is determined from a metacentric formula:

$$\theta_d = \theta_0 + 57.3 \frac{2 M_{heel}}{D(r-a)} \text{ degrees}, \tag{4}$$

where θ_0 — initial heeling due to the effect of load, boom, balance weight, etc.;
M_{heel} — heeling moment caused by the wind pressure;
D — displacement of the crane;
$r-a$ — initial metacentric height determined with taking into account the effect of free surfaces of the liquid cargoes.

In case the floating crane has no initial heel the value of θ_0 in formula (4) shall be assumed to be zero.

§ 5. Stability of a nonworking floating crane, that is, with no load on its hook, shall be checked for the highest position of the boom, loading condition with 10% of stores and fuel, but without liquid ballast.

Stability is considered sufficient if the dynamically applied heeling moment due to the wind pressure (M_{heel}), see § 6, is at least twice less the minimum capsizing moment (M_{caps}), see § 7, that is, the following conditions are met:

$$2M_{heel} \leqslant M_{caps}$$

or

$$K = \frac{M_{caps}}{M_{heel}} \geqslant 2 \tag{5}$$

§ 6. The dynamically applied heeling moment caused by the wind pressure is determined from the formula:

$$M_{heel} = .001 \sum k_i S_i q_i z_i \ tm \tag{6}$$

where S_i — components of calculated sail area of a floating crane in m^2;
k_i — aerodynamic flow coefficients;
q_i — value of wind pressure in kg/m^2;
z_i — vertical distance from the effective waterline up to the centre of gravity of the S_i area.

The calculated wind pressure q_i is assumed depending upon the height of the sail area. Total height of the crane in this case is divided into several zones, each zone 20 *m* high, beginning from the sea surface. Within each zone the calculated pressure is assumed to be constant and is determined from Table 10.

Table 10

Limits of zone height, *m*	0—20	20—40	40—60	50—80	80—100	Over 100
Calculated wind pressure q_i, kg/m^2	100	116	132	148	164	180

The aerodynamic flow coefficients k_i for the crane sail area components are assumed in accordance with Table 11.

Table 11

No.	Components of crane sail area	k_i coefficients
1	Trusses and continuous plate beams	1.4
2	Crane drivers' cabins, balance weights, pontoon, etc.	1.2
3	Cables, ropes, guys, etc.	1.2

For tubular structures the flow coefficient is assumed depending upon the product of calculated pressure q in *kg* per sq. m. by the square of the tube diameter. When

$$qd^2 \leqslant 1\ kg \qquad k = 1.2$$

$$qd^2 \geqslant 1.5\ kg \qquad k = .7$$

For a structure with continuous sides the calculated sail area is the area restricted by its shape minus the openings between girders, if any.

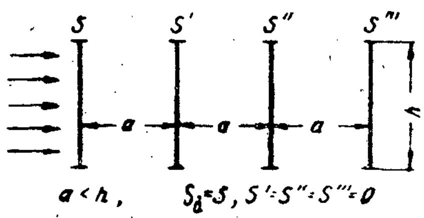

Fig. 11

The value of the calculated sail area is devided into sections corresponding with its division into zones.

The calculated sail area for a crane having several girder planes, both continuous and lattice, located one after another, is as follows.

1. With the same height of girders:

(*a*) with the distance between the girders less than the height of the front girder — by the area of the front girder (Fig. 11);

(*b*) with the distance between the girders equal to or greater than the girder height but less than its double height — by full area of the front girder and 50% of area for each subsequent girder (Fig. 12);

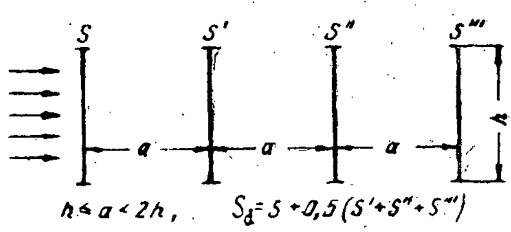

Fig. 12

(*c*) with the distance between the beams equal to and greater than its double length — by full area of all girders (Fig. 13).

2. With unequal height of the girders the parts of the rear ones that are not overlapped by the front girder shall be taken into account entirely.

The vertical distances — z are measured from the actual waterline to the CG of the sail areas of the corresponding components that are part of a given zone when the floating crane pontoon is in upright position.

§ 7. The minimum capsizing moment is determined from the dynamic stability curve plotted without considering the effect of free surfaces of the liquid cargoes and shown in Fig. 14a. To this end, provided the crane has no initial heeling, set off OB equal to one radian from the origin of coordinates and draw a tangent OE to the curve of dynamic stability.

Erect a perpendicular from point B until it intersects with the tangent to the curve in point C. Line BC is equal to the minimum capsizing moment M_{caps} if the curve is plotted on the scale of work done or to the arm l_{caps} if it is constructed on the arm scale. In the latter case the minimum capsizing moment is determined from the formula:

$$M_{caps} = D l_{caps}. \tag{7}$$

If the floating crane has initial heeling θ_0 the dynamic stability curve is like that shown in Fig. 14b. To determine the minimum capsizing

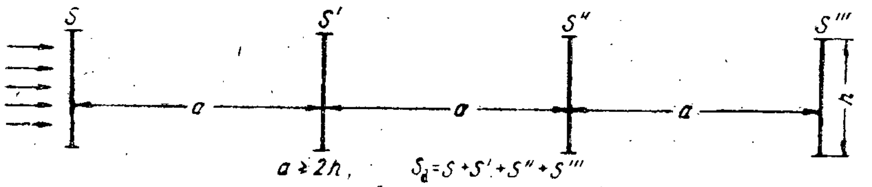

Fig. 13

moment, set off from point A corresponding to the curve minimum a line AB parallel to the X-axis which is equal to one radian (57.3°) and draw a tangent AE to the curve. Erect a perpendicular from point B until it intersects with the tangent in point C. Line BC is equal to the minimum capsizing moment or its arm, depending upon the curve scale.

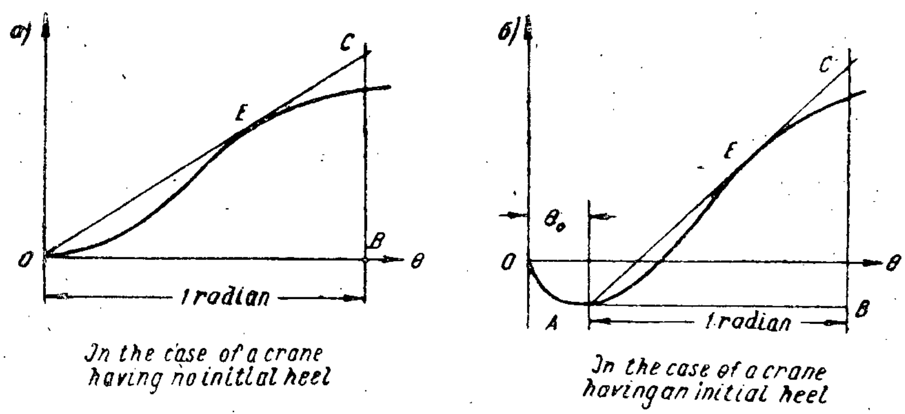

Fig. 14

§ 8. If a floating crane is to pass through a sea or an ocean under more severe conditions than those specified in the stability standards, the passage plan should be worked out and submitted to the Register of Shipping of the USSR for approval.

The passage plan should provide for all arrangements required to ensure sufficient stability of the floating crane and its safety against capsizing. The crane boom should be in a position most favourable for the crane stability or in case of necessity it should be completely or partially dismantled. Particular care should be taken for due tightness of opening covers, preventing water from entering inside the pontoon hull.

In the course of the passage permanent survey should be kept for sufficient tightness of the opening covers and check for accumulation of water.

The stability of the floating crane as assigned in the passage plan, shall be checked for compliance with the recommendations as follows:

(a) stability is considered sufficient if the following unequality is true:

$$K = \frac{M_{caps}}{M_{heel}} \geqslant 1.0\,, \qquad (8)$$

where M_{caps} — is the minimum capsizing moment determined with due account for rolling;

M_{heel} — the heeling moment caused by the wind determined in accordance with the instructions given in § 6;

(*b*) when determining the minimum capsizing moment during the passage, the rolling amplitude for all floating cranes is assumed $\theta_m = 15°$.

A method for determination of the minimum capsizing moment from the curve of dynamic or static stability with due account for rolling is given in § 11, Part I.

§ 9. To ensure due stability of floating cranes in service, the master of each floating crane should be supplied with the "Information on Stability of the Floating Crane" approved by the Register of Shipping of the USSR and presenting:

(*a*) the data on stability for various outreaches of the boom and different loads on the hook;

(b) instructions concerning the service limitations and arrangements that are necessary to ensure the safety of a floating crane against capsizing.

§ 10. "The Information on Stability of the Floating Crane" shall be compiled on the basis of the inclining test of the particular crane and determination of actual position of the crane centre of gravity based on the data of the inclining test.

The inclining test with subsequent calculation of the centre of gravity and stability shall be carried out on cranes as follows:

(*a*) all the cranes under construction;

(*b*) cranes under overhauling, modernization or alteration;

(*c*) all the cranes the stability of which gives rise to doubt.

N o t e. If the centre of gravity of a floating crane does not coincide with the fore and aft line of the pontoon, the arms of dynamic stability l_d are calculated with the aid of the formula as follows:

$$l_d = l_{d_1} - y_g \sin\theta\,, \qquad (9)$$

where l_{d_1} — is the arm of dynamic stability calculated assuming that the centre of gravity of a floating crane coincides with the centre line of the pontoon;

y_g — distance of the centre of gravity of a floating crane from its centre line.

INSTRUCTION FOR DETERMINATION OF THE VESSEL'S CENTRE OF GRAVITY BY THE INCLINING TEST

§ 1. General requirements

The inclining test for determination of the position of the vessel's centre of gravity is carried out by Shipowner or Manufacturer in presence of the Surveyor of the Register of the USSR, according to this instruction.

The inclining test may be carried out by means of both ballast shifting and running of the crew; in the latter case the heeling angles are recorded by Amayeff inclinograph. The data obtained by inclining test shall be submitted to the District Office of the Register of the USSR in form of the record attached to this instruction.

§ 2. Weather conditions and position of the vessel during the test

The inclining test shall be carried out in calm weather and in smooth water, when there is no stream.

If the test is performed under less favourable weather conditions, that is: light wind of not more than 1.5 in force, light ripples on the water surface, or when there is a stream, the vessel's bow should be kept to the wind or stream by means of longitudinal lines of not more than four (best of all: two) in number, long whenever possible and gripped together below the side hawses.

When performing the test the mooring ropes shall be slacked before every reading in order to ensure that the vessel is free to incline. It is necessary also to watch closely that the hull of vessel does not touch with the quay, bottom or a ship nearby; the gangboard should be shipped.

In exceptional cases, a vessel lying at anchor is permitted to be subjected to the inclining test; in this case the number of shackles veered out shall be included into the record and the weights of the anchor and the chain lying on bottom shall be included into the missing cargo list.

The weather conditions and position of the ship during the experiment should be included into the inclining test record.

§ 3. Preparing the vessel for test

The vessel subjected to the test shall be in light condition but with full equipment. All objects and cargoes being a part of the equipment and not included into the deadweight, such, as: anchors, chains, boats, life-saving appliances, navigational means, spares for vessel and machinery shall be in the positions they are to be under service conditions. All cargoes and objects (derricks) which can be moved when the vessel is inclined shall be secured. All tanks for water, machine oil and bunkers for oil fuel, in general, shall be absolutely empty.

The boilers shall be filled with water to the working level and the correction for the free surface effects produced therein may be not taken into consideration due to its small value. When the boilers are not filled with water, the weight of the water in boilers should be entered into the missing cargo list.

The test is permitted to be carried out with full supply of water, fuel, oil in tanks and full or partial supply of solid fuel in bunkers. The fuel in the bunkers in this case should be levelled to simplify the calculation of cubic capacity and weight. Free surfaces in the tanks should not be permitted.

When it is impossible to drain the tanks or fill them completely, the value and position of the free level should be determined as carefully as possible.

The Surveyor of the Register of the USSR shall satisfy himself before performing the test that the holds and machinery and boiler rooms are drained off and all cargoes and objects in the vessel have been taken into account.

In flat bottomed ships after pumping out the water from the hull by means of bilge pumps or water discharging ejector, the remainder of water below the strainer should be removed by means of buckets or hand pump.

In ships with inclined bottom when absolute pumping out is impossible, the water in amount of up to 5—6 *cm* in height is permitted to be amidships, in the wedge part of the vessel's bottom.

The loose water may be detected from the inclinogram (See Fig. 5) of Amayeff inclinograph. In case of inclining the vessel by means of crew running, the angle of inclination on the inclinogram continues rising during 1—2 minutes after the persons have formed up due to the influence of free surfaces of liquids.

In case of need, the Surveyor of the Register of the USSR may demand elimination of the free surfaces detected.

The initial position of the ship may be upright or inclined on either side to not more than 1°.

§ 4. Ballast for inclining test

In order to carry out the inclining test by means of ballast shifting, a ballast should be put aboard, the weight of which is to be equal to about .5—1% of the ship's displacement, so that, with a given length of the plumb lines, the heel ensuring the necessary accuracy of measuring can be obtained.

Cast iron pigs, grate bars, steel ingots, or bags with sand may be used as the ballast.

The weight of the ballast should be determined preliminarily in presence of the Surveyor by means of weighing with accuracy to within 1% and its value should be marked with paint on each piece of the ballast.

The ballast aboard the ship for performing the test shall be divided into four groups approximately equal in weight and put symmetrically against the centre of gravity of the actual waterplane. In exceptional cases the sea water pumped into wing ballast tanks, as well as heavy cargoes suspended to the derrick and outlaid thereby overboard, may be used as a ballast for inclining test.

If the inclining test is performed by means of liquid ballast, careful attention should be paid to determine accurately the weight and position of the centre of gravity of the ballast used.

The weight of the ballast may also be determined by means of a calculation, but in this case special attention should be paid to the correct and sufficiently accurate determination of the volumes and centres of gravity of the volumes of tanks and compartments used for ballast. The filling factor for these tanks and compartments shall be determined accurately enough. The level of liquid therein shall be carefully measured after each re-pumping process. The effect of the free level of liquid ballast on the stability of the vessel shall be negligibly little.

The remainder of ballast which cannot be re-pumped should be carefully determined after each re-pumping process. The permissible error in determination of the inclining moment produced after each re-pumping, should not exceed .2% of its value. Conformity of the tank and compartments used for ballast with their drawings should be checked up on the spot. The centre of gravity of ballast during each re-pumping process should shift in a direction sufficiently close to the cross-horizontal. All possibilities of any changes in weight of the ballast when in the vessel and when re-pumped, should be absolutely eliminated. The quantity of the ballast should be carefully checked up before the very beginning of the test and immediately after its completion.

On completion of the test the ballast shall be in its initial position.

When the inclining test is carried out by means of the running of crew, the total weight of the persons should be within .1—.2% of displacement of ship, but the test may be also performed if there is a greater number of persons. The weight of each person taking part in the test should be determined by weighing and recorded. At the worst, when the metacentric height is determined approximately, the weight of persons may be taken according to interrogation or according to the weight of an average person.

At an average, the weight of a person with summer clothes on is 62—67 *kg* and with light winter clothes on — 65—70 *kg*.

For convenient measurement of the arm of running of the persons from one side to the other, it is reasonable to form up the crew along the bulwark or deck plating seam.

§ 5. Surplus and missing cargoes[1]

Before performing the inclining test it is necessary to make the lists of all missing and surplus cargoes and materials in vessel, as regards their normal supply, indicating their position in the vessel at the length and height (See Tables 1 and 2).

In case of performing the test by means of crew running, the persons taking part in running should be considered as surplus cargo and their centre of gravity is accepted situated on the deck on which the running takes place. (The analogy between a suspended cargo and a person can be drawn here: when the vessel has a heel, the person would try to keep upright position against the horizon, the centre of turning being in the place where the soles are contiguous with the deck).

§ 6. Determination of the angles of inclination

The angles of inclination may be estimated by different methods: plumb lines, connected vessels, Amayeff inclinograph, etc.

When using the plumb line its thread should be as long as possible for a given ship.

For large ships the length of the thread of plumb line is recommended to be equal to 4.0—6.0 *m*, for small ships—at least 1.5 *m*. The diameter of the thread shall be about .5 *mm*. Before beginning the test the thread should be stretched by means of suspending a load. A wire of .25 *mm* in diameter may substitute for the thread. The load of the plumb line shall be dipped into a tank with water or oil in order that the swinging of plumb line can damp more rapidly. For this purpose, a vane made of two interperpendicular plates should be attached to the end of the plump line.

The plumb lines shall be not less than two in number: it is recommended to have 3 of them. The places for suspending the plumb lines are chosen depending on local conditions.

Wooden planed battens without any points graduated thereon are placed possibly nearer to the thread of plumb line, to take the readings of the angles of inclination, so that they do not touch with the plumb lines and are perpendicular to the centre line.

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[1] The word "cargo" is used here and after in the sense of "load".

A paper tape with a straight line drawn at full length of the strip and graduated on distances of 1 *cm* each should be attached to each batten. When taking a reading, the limits of divergences of the plumb line to the right and to the left (with an amplitude of 5—10 *mm*) for 4—5 complete swingings being read off should be entered in a prepared blank without waiting for an absolute damping of the plumb line swingings.

Arithmetical mean of 8—10 readings of athwart swingings of the plumb line, taken in that way, is accepted as actual divergence.

In order to decrease the relative error for reading, the divergence k of plumb line, at maximum heel of the ship during test, from a position which corresponds to the upright position of the ship, is recommended to be not less than 150 *mm.*

The length of plumb line λ is measured from the point of suspence to the scale on which the divergences are read off.

The angle of inclination for a given divergence is determined by formula:

$$\operatorname{tg} \theta = \frac{k}{\lambda}.$$

If the divergences are determined by means of connected vessels, the procedure shall be as follows: two glass tubes of 10—20 *mm* in diameter and 1.0—1.2 *m* in height are connected with a rubber pipe, the junction being tightly winded with a thread or wire, then one glass tube is fitted in upright position on the starboard and the other one on the port strictly in the plane of the same frame and at the same height above the deck. After fitting and securing the tubes, coloured water is poured into one of the tubes so that the level of water is approximately halfway up the tubes (at initial heel of the ship the level of water in tubes will be different against the deck). In this case the distance between tubes should be measured instead of the length of plumb line and corresponding divergences are defined by displacement of water levels. This method may be especially recommended in such cases, when use of the plumb lines of sufficient length is impossible due to local conditoins. Attention shall be paid to prevent the water in the rubber pipe from being filled with layers (bubles) of air, the existence of which distorts the results obtained.

When performing the test of inclination by means of crew running and making the measurements by means of Amayeff inclinograph, the values of heeling angles are recorded in the inclinogram in one of the selected scales (instruments manufactured in 1950 have 3 scales for reading) in accordance with instructions, attached to each instrument.

§ 7. Measurement of draught and calculation of displacement

To avoid the constant and systematic error, irrespective of the number of readings, it is necessary to determine displacement, corresponding to the load condition during the test as accurately as possible, for the purpose of which the draught should be determined very carefully by one of the methods mentioned below.

The draught of the vessel shall be measured as accurately as possible at the start of the test on the draught marks, for the purpose of which a boat or a raft is recommended to use.

In order to measure the draught of small ships (tugs, launches, etc.) it is necessary to observe that when measuring the draught, the number of persons on board ship is the same as during inclining.

To facilitate the measurement of draughts when there is a slight heaving of the sea, a glass tube open from both sides is recommended to be used, one end of which being dipped into sea to a certain depth.

In addition to the measurement on draught marks, it is recommended to measure the freeboard in three different sections at the length of the ship.

The measurements of draughts taken from the draught marks and on basis of the freeboard height should be made from both sides and arithmetic mean shall be taken to eliminate influence of initial heel.

In general, the draught marks are graduated on stems from the lower edge of keel and the draught for determining displacement is taken on the basis of hydrostatic curves or Bonjean scale from the upper edge of keel.

This shall be taken into account when calculating the displacement.

As a control of the correctness of draught measurements the actual waterline should be plotted on the line drawing on the basis of draught marks taking into account the height or thickness of keel and on basis of three values of freeboard height measured. When the measurement has been made accurately both these waterlines should be practically matched. If the waterlines are diverged, preference should be shown to that method which was more accurate or the average position of the waterline must be accepted.

The displacement should be computed using Bonjean scale and using the displacement curve only when there is no trim. When the waterline is plotted on Bonjean scale, the correction for lack of coincidence of the draught marks with the position of theoretical perpendiculars of the ship should be taken into consideration. When there is a raking stem, the stem line with the draught mark scale is recommended to be plotted on Bonjean scale.

When the Bonjean scale is not available, the displacement should be computed using the line drawing by means of planimetrying the submerged frame areas. On the basis of the volume displacement V obtained, the weight displacement is determined from the formula:

$$D = \gamma k V.$$

where γ — the density of water, which is accepted equal to 1.025 (average salinity) for Atlantic and Pacific Oceans, 1.016 — for Baltic Sea and 1.00 for fresh water; for accurate measurements it is desirable to determine the density of sea water by an areometer;

k — a coefficient, which takes into account the displacement of appendages, is accepted equal to 1.006.

On small ships (launches, etc.) the draught is not recommended to be measured by means of a set square (hook), due to extreme inaccuracy of this method.

§ 8. Test error

When inclining by means of ballast shifting, the absolute error for a single reading of the plumb line, due to vibration and swinging of the thread, reaches 2—3 *mm*. The measured value of divergence is not great and when being determined, the mistake is made twice: in initial and final readings, which on the whole leads to an absolute error of up to 4—6 *mm*.

In order to decrease the relative error of experiment, caused by inaccurate determination of divergences, the readings shall be taken from 2—3 plumb lines, the experiment shall be carried out several times and the results shall be arranged by method of the least squares. The method for determining the probable relative error of the test results is indicated in the form of record of inclining test, given below.

When performing the test, some of the readings taken may be found inaccurate for some reason or other and when working out the test results they are not recommended to be taken into account. In order to reveal such inaccurate readings it is useful to plot a control diagram, along the axis of ordinates of which the values of full heeling moments in scale are laid off and along the axis of abscissa — corresponding heeling angles which have been measured separately by means of each plumb line. The points plotted in that way shall be situated on the straight line of inclination passing through the origin of coordinates. The points situated far from this line are considered as improper, and the readings corresponding thereto shall be rejected. An example of plotting the control diagram is given in Fig. 1.

In general, the relative error when measuring the plumb line length by tape is small and may be not taken into account.

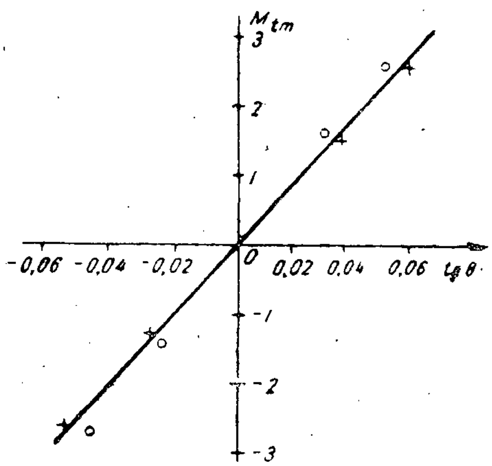

Fig. 1

When making measurements by means of Amayeff inclinograph, the error for estimation of the heeling angle when recording 5—6 positions, is not more 1—2% as stated in the instructions to the instrument.

The error of the metacentric formula for straight-sided ships:

$$l = (r - a)\sin\theta + \frac{r}{2}\,\mathrm{tg}^2\theta\sin\theta$$

reaches 1% if the second member of the formula is neglected and if the heeling angles do not exceed 4°.

For ships with streamlined hull the heeling angles may be accepted much greater, because the error of 1% is obtained therein approximately at 10°.

The error when determining the weight of the ballast reaches 1%. The distance the weight is moved during the test may be measured with accuracy to within .5%.

The accuracy of determination of the displacement under test conditions depends on degree of accuracy of the draught measurement. The relative error may be derived from the formula:

$$\frac{\Delta V}{V} = \frac{S\Delta T}{V},$$

where s — the actual waterplane;
ΔT — the error for draught measurement.

In general, ΔT is .005—.010 m depending on condition of sea surface, existence of ripples, etc.

If the said formula gives an error under 1%, it should be accepted

$$\frac{\Delta V}{V} = \pm 1\,\%,$$

because it is the accuracy for determining the displacement on the basis of line drawing.

The full possible relative error of test is equal to the sum of all separate relative errors. It is given in the following table:

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No.	Error	Symbol	Method of heeling: ballast shifting (the heeling angle is measued by plumb lines), %	Method of heeling: crew running (the heeling angle is measured by Amayeff inclinograph), %	Note
1	2	3	4	5	6
1	Reading error	$\frac{\varepsilon}{n}$	3.5	1.0—2.0	
2	Error of metacentric formula	$\frac{\Delta h}{h}$	1.0	1.0	
3	Error for displacement determination	$\frac{\Delta V}{V}$	1.0—2.0	1.0—2.0	
4	Error for determination of the ballast (Persons) weight	$\frac{\Delta p}{p}$	1.0	1.0—3.0	When interrogating, the error for determination of the persons' weight may reach 3%
5	Error for determination of the shifting (running) arm	$\frac{\Delta l}{l}$	.5	.5	
	Total possible error		7—8	4.5—8.5	

§ 9. Performing the inclining test by method of ballast shifting

It is necessary before the beginning of the test to make sure that the ship is properly prepared to the inclining test in accordance with the requirements of § 3 of the Instruction. Then the water should be pumped into the boiler to working level. Approximately .5 *t* of coal or 1 m^3 of fire wood shall be loaded into the stokehold to keep up the steam in the boiler during the experiment (2—3 hours). Send ashore all unnecessary persons, delaying only those required for moving the weight across the deck from one side to the other and for carrying out other operations during the test, ship the gangboard connecting the vessel with the shore or with other ships. Then all members of the crew except the engine man on watch are called on deck and each should take his fixed place outlined by chalk. The persons observing the divergences of the plumb lines take their places opposite the battens of corresponding plumb lines, satisfying themselves preliminarily, that the threads of the plumb lines do not touch with the batten.

Before the readings are taken, the measurement of the draught from the raft or boat and the measurement of the freeboard height are made in compliance with § 7 of the Instruction. Assuming that the ballast has been distributed into equal portions along both sides, its stowage places are outlined by chalk and the arms *l* (the distance between the centres of gravity of the ballast portions on starboard and port are measured by a tape (Fig. 2), give a command: "All hands to your places", slack away the lines keeping the ship so that they cannot interfere with her inclination.

When the ship and the plumb lines stop to swing, the observers record in the prepared blanks the limits of the plumb line swinging, marking them with No. 1. After the signal: "ready" given by the observers, the first portion of the ballast is moved from the port to starboard and stowed in fixed places. Then the commands: "To your places" and "Slack away the lines are given and after the ship and plumb lines stop to swing, the second reading of the plumb lines is taken and recorded in the blank, being marked with No. 2.

On completion of the records, the second portion of the ballast is moved from the port to starboard and the same observations are repeated with recording the position of the plumb line on the scale.

Then the portions of ballast are moved in the same order back from the starboard to port. In this case are repeated the same positions as those during the first series of observations, the position of the plumb line thread on the scale being noted each time.

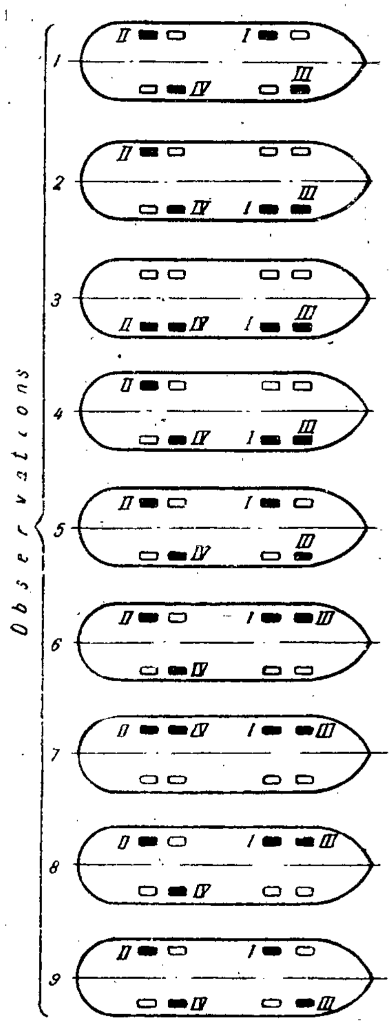


Fig. 2

After that the ballast is moved in the same succession on the other side and backwards and the readings of the plumb lines are recorded every time under corresponding numbers. As a result the ballast after all movings will be distributed symmetrically on both sides of the vessel in the same manner as at the start of the test. The scheme of the ballast positions for each observation is shown in Fig. 2.

It is necessary at each inclination to make sure that the ship is free to incline.

Records No. 2 and 4, 1, 5 and 9, 6 and 8 shall be identical because they correspond to the same distribution of the ballast at the constant shifting arm. Due to inevitable test errors, movement of the water in the boilers, the said readings show a small difference corresponding to the angle of about 5—10 min.

If during each moving either the cargo or the arm were changed, or the succession of movings differed from the stated one, the moments of moving will be different and therefore, there will be no coincedence of divergencies.

When performing the test special attention shall be paid to accurate recording of the divergences, especially when the latter are small—about 50—60 *mm*—since otherwise the relative error can reach about 10%.

On completion of the test the absolute values of the plumb line divergences, weight of the ballast moved, arm for each reading and the values of draughts are entered in the inclination record, the form of which is given below.

§ 10. Performing the test when measuring the heeling angles by means of Amayeff inclinograph

Before beginning the test it is necessary to make sure that the vessel is properly prepared to the inclining test. All tanks in the vessel should be either full or empty.

The liquid cargoes in all small tanks, hull and on the deck should be inventoried. During the test the draught is measured from the raft or boats and the freeboard height is measured in compliance with § 7 of the Instruction.

During the test everyone aboard without fail shall be on the upper deck and shall take part in the runnings across the deck from one side to another; the persons taking no part in the runnings shall be sent ashore. One watchman is permitted to be in the engine room and one near the boilers, if the latter should be under superintendence. During the test the watchmen should be on the centre line.

In all cases after the persons have run across the deck from one side to the other, the zigzag records reproducing the swinging of the vessel shall be necessarily achieved.

If there are no such records then the measurement is inaccurate and the cause, preventing the vessel from free swinging shall be revealed.

The inclinograph is placed athwartship, at a distance not more than a quarter of the length of the ship from the midship along the centre line, on the table, efficiently fastened to the deck.

The instrument is prepared to the test in accordance with the instructions for use attached to each instrument set, the detailed description of its construction being also given there. An especially trained person responsible for the safety of the instrument and its good condition is charged with operating and maintaining of the instrument.

The metacentric height may be determined by means of one of the two methods:

1) on the basis of the heeling angle;
2) on the basis of the period of free swinging.

The first Method

The metacentric height is determined from the expression:

$$h = 57.3\,\frac{Pb}{D\theta},$$

where P — is the weight of the inclining cargo (persons) in t;
b — is the arm of cargo shifting or crew running in m;
D — is the displacement of the ship in t;
θ — is the heeling angle in degrees taken from the inclinogram, it is accepted as arithmetic mean of several inclinations of the vessel;
h — is the metacentric height in m.

Performing the test

When the ship is in upright position, draw a middle line on the inclinogram, turning the drum by hand. After that, form up all the persons taking part in runnings on the starboard along the line outlined by chalk and parallel to the centre line (the distance between the line on starboard and that of port is the arm of running).

Begin recording. After a span of time of 1 or 1.5 min. give the command: "All hands on port, double march". At the executive command "march" the persons as fast as possible run across the deck to port and form up on port along the line outlined by chalk (the distances between the lines on starboard and port and the centre line shall be approximately the same; the distance between the lines being measured by tape).

In this case the ship will incline and the pen on the drum of the instrument will pass to a new position. After the expiry of 1—1.5 min. required for recording this new position by the instrument, give the command: "All hands on starboard, double march". This position of the ship is to be recorded at the same time.

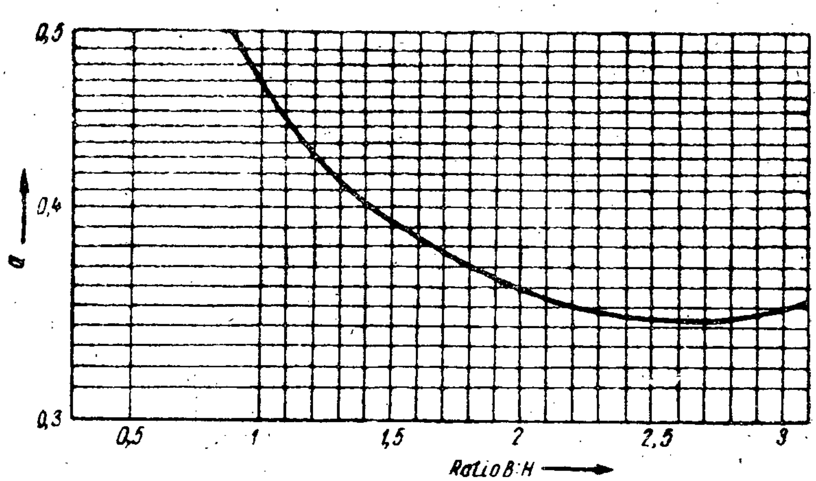
At least 5—6 positions shall be recorded, the whole test being continued for about 6—7 min.

If the divergencies in the subsequent records coincide with the initial ones, it means that the records are satisfactory and the test may be considered as completed.

The mean value obtained from the records worked out (at least 5 positions) is assumed to be the heeling angle. The metacentric height is calculated from the formula given above.

The second Method

The second method is less accurate than the first one and therefore may be used only in cases requiring no accuracy, as well as for checking the value of the metacentric height obtained by the first method.



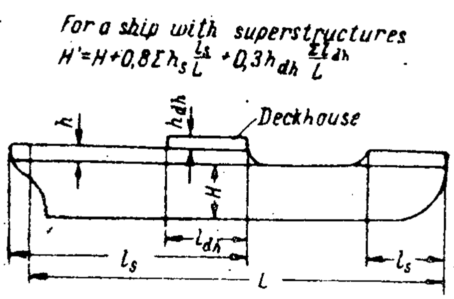


Fig. 3. The dependence between the coefficient of the ship's inertia and the ratio breadth to depth of the ship

The metacentric height is determined through the period of rolling of the ship in smooth water, from the formula:

$$h = 4a^2 \left(\frac{B}{\tau}\right)^2,$$

where a — coefficient depending on the ratio $B : H'$, determined from the diagram (See Fig. 3);

B — breadth of the ship in m;

H' — depth of the ship with due regard for superstructures in m;

τ — period (in seconds) of free swinging of the ship in smooth water, which is determined from the diagram.

The diagram of values a applies only to ships with usual lines and with usual configuration of the superstructures and therefore the second method is not suitable for pontoons, floating cranes and similar vessels with unusual lines.

The free swinging of the vessel at moorage may be caused by fast

State of sea — 0 balls. Wind — 2 balls
Sketch of mooring

Power station
Manager . . . . .
Berth, mooring ropes, anchor chain, wind direction

Inclinations are obtained due to the running over of 37 persons

Weight	Arm	Moment
2,440 t	10,0 m	24,4 tm
Σ2,45 t		ΣM 24,4 tm

Transference of the pen

Record 1 — 2 $x_{12} = 15,5$ mm
„ 2 — 3 $x_{23} = 15,2$ „
„ 3 — 4 $x_{34} = 15,1$ „
„ 4 — 5 $x_{45} = 15,0$ „

$x_{56} = 14,8$ mm
$x_{67} = 14,5$ „
$x_{78} = 15,0$ „

$x_m = 15,0$ „

Scale of angle record $1° = 19,9$ mm
Mean angle $\vartheta_m = 0,755°$
Metacentric height

$$mg_1 = 57,3\,\frac{\Sigma M}{D\vartheta} = \frac{57,3 \cdot 24,4}{967 \cdot 0,755} = 1,92\ m$$

Period of free swinging of the vessel

$\tau_1 = 4,65$ mm $\tau_5 = 4,3$ mm Mean $\tau = 4,55$ mm
$\tau_2 = 4,2$ „ $\tau_6 =$ . . . „ Scale of time
$\tau_3 = 4,6$ „ $\tau_7 =$ . . . „ 1 sec = 0,7 mm
$\tau_4 = 5,0$ „ $\tau_8 =$ . . . „ $\tau_m = 6,5$ sec

Coefficient or inertia (from the experiment):

$$a = \frac{\tau\sqrt{mg}}{2B} = \frac{6.5\sqrt{1,9}}{2 \cdot 10,97} = 0,41$$

Moment of inertia of the vessel's mass (and „entrained water")

$$I = \rho_i^2\,\frac{D}{g} = a^2B^2\,\frac{D}{g}$$

Ratio $\frac{B}{H'} = 1,4$; H' — the depth according to the fig. 3

$\overline{O}g$ — rising of the centre of gravity above the keel $= OC + \rho - m_g$;
OC — rising the centre of bouyancy above the keel;
ρ — the metacentric radius

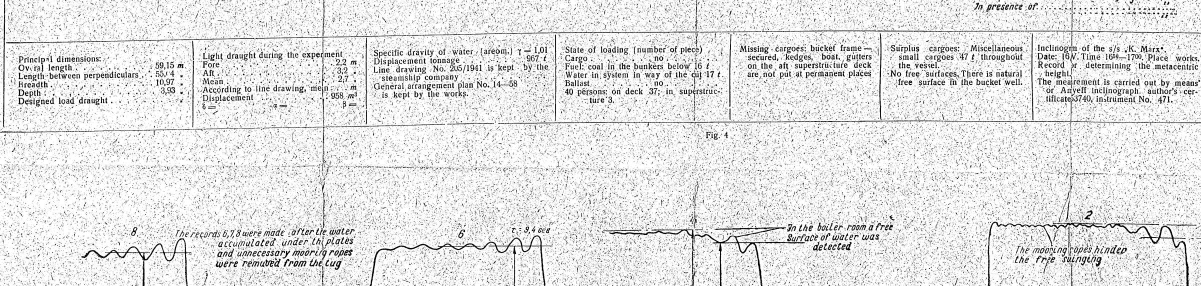
When $\frac{B}{H'} = 1,4$

$$a = f\left(\frac{B}{H'}\right) = 0,40$$

(the mean statistic fig. 3)

$$mg_2 = 4a^2\left|\frac{B}{\tau}\right|^2 = 0,40^2\left(\frac{10,97}{6,5}\right)^2 = 1,83\ m;$$

$$mg = gm_1 = mg_2 = 1,83\ m$$



Inspector of the Register of the USSR.... (Signature)
The experiment has been carried out by engineer....„
In presence of........................„

Principal dimensions:
Overal length . . . . 59,15 m
Length between perpendiculars . . 55,04 „
Breadth . . . . 10,97 „
Depth . . . . 3,93 „
Designed load draught . . . . „

Light draught during the experment
Fore . . . . 2,2 m
Aft . . . . 3,2 „
Mean . . . . 2,7 „
According to line drawing, mean . . . m
Displacement . . . . . . 958 m^3
$\delta =$ $\alpha =$ $\beta =$

Specific dravity of water (areom.) $\gamma = 1,01$
Displacement tonnage . . . . . 967 t
Line drawing No. 205/1941 is kept by the steamship company
General arrangement plan No. 14—58 is kept by the works.

State of loading (number of piece)
Cargo . . . . . . no . . . . . .
Fuel: coal in the bunkers below 16 t
Water in system in way of the cut 17 t.
Ballast . . . . . . no . . . . . .
40 persons: on deck 37; in superstructure 3.

Missing cargoes: bucket frame — secured, kedges, boat, gutters on the aft superstructure deck are not put at permanent places

Surplus cargoes: Miscellaneous small cargoes 47 t throughout the vessel.
No free surfaces. There is natural free surface in the bucket well.

Inclinogm of the s/s „K. Marx".
Date: 16/V. Time 16[50]—17[00]. Place works.
Record or determining the metacentric height.
The meairement is carried out by means or Anyeff inclinograph, author's certificate 3740, instrument No. 471.

Fig. 4

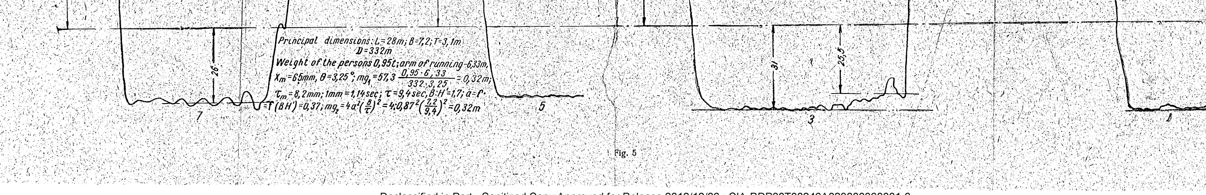


Fig. 5

State of sea — 2 balls. Wind — 3 balls
Sketch of mooring
Berth, mooring ropes, anchor chain, wind direction

Inclinations are obtained due to the running of 53 persons

Weight	Arm	Moment
3,24 t	11,75 m	38 tm
„	„	„

Transference of the pen

Record 1 — 2 $x_{12} = 25,5$ mm $x_{56} =$ mm
2 — 3 $x_{23} = 25,0$ „ $x_{67} =$ „
3 — 4 $x_{34} = 25$ „ $x_{78} =$ „
4 — 5 $x_{45} = 25$ „ $x_m = 25,1$ „

Scale of angle record 1° = 20 mm
Mean angle $\theta_m = 1,26$ degrees.
Metacentric height

$$mg_1 = 57,3 \frac{\Sigma m}{D\theta} = \frac{57,3 \cdot 38}{5420 \cdot 1,26} = 0,32 \ m$$

Period of the vessel's free swinging

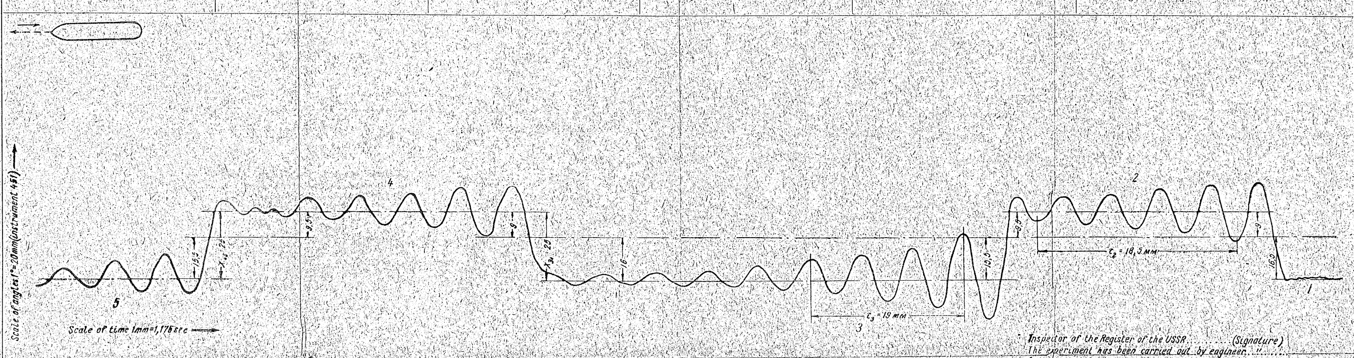
$\tau_1 = 18,5$ mm $\tau_5 =$ mm Mean $\tau = 1875$ mm
$\tau_2 = 1$ „ $\tau_6 =$ „ Time scale
$\tau_3 = 19$ „ $\tau_7 =$ „ 1 sec = 0,85 mm
$\tau_4 = 18,5$ „ $\tau_8 =$ „ $\tau_m = 22,0$ sec.

Coefficient of inertia (from the experiment)

$$a = \frac{\tau \sqrt{mg}}{2B} = \frac{22 \sqrt{0,32}}{2 \cdot 13,7} = 0,455.$$

Inertia moment of vessel's mass (and „entrained water)"

$$I = R_i^2 \frac{D}{g} = a^2 B^2 \cdot \frac{D}{g} = 0,455^2 \cdot 13,7^2 \frac{5420}{9,81} = 21500 \ tm \ sec^2$$



Inspector of the Register of the USSR .... (Signature)
The experiment has been carried out by engineer " ....
In presence of .... "

Fig. 6

Principal dimensions:
Overal length . . . . m
Length between perpendiculars . . 113 „
Breadth . . . . 13,7 „
Depth . . . . 9 „
Designed load draught . . . . 7,42 „

Light draught . . . . m
During the experiment —
Fore . . . . 4,7 m
Aft . . . . 5,8 „
Mean . . . . 5,2 „
according to line drawing, mean . . 5,26 „
Displacement . . . . . . 5300 m^3
$\delta = 0,65$, $\alpha = 0,75$, $\beta = 0,95$

Specific gravity of water (areom.) $\gamma = 1,02$
Displacement tonnage . . . . . 5420 t
Line drawing No 193, drawing of hydrostatic curves is kept by the Master.
General arrangement plan No . . is kept by the Master in the passport

State of loading (number of pieces)
Cargo: . . . . . no
Fuel: 300 t of coal in bunkers.
Water in double bottom . . . . . 760 t
Solid ballast . . . . . 900 t on the inner bottom.
56 persons: 55 on deck, 1 in machine room

Missing cargoes:
no

Surplus cargoes:
about 1 0 t (see the list)
Free surfac s
In t e system the feeding water is indicated in the report

Inclinogram of the s/s „Lomonosoff"
Name of the ship
Date: 7/V-54. Time 16—16.20
Place: Vladivosiok, roads
Record for determining the metacentric height
The measurement is carried out by means of Amayeff, inclinograph Author's certificate 5374, instrument 451

movement of several persons across the deck from one side to the other, lifting any cargo from shore by the vessel's crane or derrick, etc. The free swinging caused in such way in large ships are imperceptible for the eye, but due to considerable increasing the inclining angles by the instrument, even very small amplitudes are distinctly noticeable.

The record of swinging is zigzag, and the period of free swinging is determined thereon by measuring in the scale of time the distance between the humps of the recorded curve. The average value of the period shall be taken from several swingings.

The period of swinging should be recorded when there are no wind and heaving.

The second method gives an approximate value confirming the order of magnitude of the metacentric height.

All the records and calculations in both the first and the second cases shall be made on the blank of the inclinogram, according to the form attached (Fig. 4, 5, 6).

On the completion of the test the weight of persons taking part in the runnings, the arm of running for each reading and the values of draught are entered in the record of inclination, according to the form attached; the filled blank of the inclinogram being also attached thereto.

The forms of inclinograms are given in Fig. 4 and 6. The middle line (dash-and-dot line) is drawn at the upright position of the ship by turning the drum of the inclinograph by hand. The figures 1, 2, 3 and so on show the ordinal number of the reading. A middle line is drawn for every reading. The distance between the middle lines of two consecutive readings will be the summary heeling angle in the scale. The distance between the consecutive peaks of curve will be the period of ship swinging in the scale. The remainder of the recordings is clear and does not require any explanation.

In Fig. 5 the examples of recording with necessary explanations are given when the conditions of the test are not observed (the mooring ropes interfere with free swinging; there is a free surface of liquid on the vessel).

RECORD OF EXPERIMENTAL DETERMINATION OF INITIAL STABILITY AND POSITION OF THE CENTRE OF GRAVITY OF THE STEAM TUG "NEVA"[1]

Principal dimensions: $L = \ldots$ $B = \ldots$ $H = \ldots$

1. Date of the test — June 1, 1947, begun at 5 p.m., completed at 7 p.m.
2. Place of the test — Basin of the Neva.
3. Weather conditions — Clear Wind force 0—.5 Smooth water. Ambient temperature — 10°C.
4. Persons executing the test and persons present during its performance — The test has been carried out by the Marine Engineer.

(Surname, name and patronymic) in presence of the Surveyor — Engineer of the Baltic Inspection of the Register of Shipping of the USSR.

(Surname, name, patronymic).

5. Special notes (position of the ship, etc.).

[1] Another variant of drawing up the documentation, according to which only the data of the test are entered in the record is also possible. The working out of the test results and determination of the centre of gravity of the ship for typical load conditions are made in a separate calculation.

The ship lay in the basin of the Neva alongside the pier, with her head up the stream; the bow and stern fasts sufficiently slacked to ensure that the ship is free to incline to both sides. The boiler was under steam. The level of water in the boiler was normal. The ship had about .5° list to port. The density of water was $\gamma=1.00$. The inclining test was performed by means of ballast shifting.

6. The draught at the start of the test.

The draught, measured from a boat, on the draught marks:

	Starboard	Port	Mean
Forward draught	2.52 *m*	2.52 *m*	2.52 *m*
Aft draught	2.71 *m*	2.73 *m*	2.72 *m*

deducting the height of the bar keel which is equal to 10 *cm* the corrected draught will be:

Forward draught $T_f=2.42$ *m*
Aft draught $T_{af}=2.62$ *m*

The position of the draught marks coincides with the theoretic perpendiculars of the ship. The error of the measurement of the draught in relation to the water surface conditions is

$$\Delta T=\pm .005\ m.$$

7. The ship's load conditions.

The ship, except that the fuel (coal), which had been preliminarily evened in the coal bunkers, remained on board, was brought into the light condition. The fore- and after peak tanks were drained and dried. The oil tank was filled.

The amount of the water in the engine and boiler room after having been pumped out by means of the water discharging ejector and drained by buckets and dippers was 5 *cm* above the keel.

The fuel in the coal bunkers was measured. It was established on the basis of the measurement that the port coal bunker contained 5.60 *t* of coal and the starboard one — 4.36 *t*. The starboard bower and its chain were missed. In lieu of the bower there was a spare anchor of the same weight placed aft.

8. The ballast for inclining test (or the number and weight of the persons taking part in the runnings).

The cast iron pigs, each 60—70 *kg* in weight, preliminarily weighed and marked, were used as ballast. The pigs were stowed in groups as follows:

Port

Group No. 1	
(between frames	16—18)
Total weight	.385 *t*
Centre of gravity above the base line	3.30 *m*
Group No. 2	
between frames	48—50
Total weight	.375 *t*
Centre of gravity above the base line	3.00 *m*

Starboard

Group No. 3	
(between frames	18—20)
Total weight	.393 *t*
Centre of gravity above the base line	3.30 *m*
Group No. 4	
between frames	50—52
Total weight	.391 *t*
Centre of gravity above the base line	3.00 *m*

The total weight of ballast for heeling is 1544 *kg*. The arm of shifting for all the 4 groups is the same and equal to $l=3.56$ *m*.

9. Position of the plumb lines.

The number of the plumb lines was 2. The plumb line No. 1 was in the fore crew's space; its rated length being 2960 *mm*. The plumb line No. 2 was in the engine room; its rated length being 3060 *mm*.

10. There were surplus cargoes in the ship during the test.

See below Table 1.

Table 1

Surplus cargoes

No.	Cargo	Position of cargo	Weight P, t	Arms*: Distance from base line z, m	Arms*: Distance forward (+), aft (−) of amidships x, m	Moments: $M_z = (4)\times(5)$ tm	Moments: $M_x = (4)\times(6)$ tm
1	2	3	4	5	6	7	8
1	Hard coal	In the port coal bunker, between frames.	5.60	1.96	1.20	10.98	6.72
2	Hard coal	In the starboard coal bunker, between frames:	4.36	1.92	1.20	8.37	5.23
3	Machine oil	To the starboard, in way of the engine hatch	.08	3.17	− .60	.25	− .05
4	Crew (4 persons)	In the fore cabin	.30	1.80	6.80	.54	2.04
5	Crew (3 persons)	In the after cabin	.22	1.80	− 7.35	.40	− 1.62
6	Crew (7 persons)	On the deck in way of the towing arc	.52	4.10	− 3.26	2.15	− 1.89
7	Crew (1 person)	In the boiler-room on watch	.07	2.25	1.25	.17	0.09
8	Observers near the plumb line No. 1 (1 person)	The fore crew's space	.07	6.00	2.30	.45	.17
9	Observers near the plumb line No. 2 (2 persons)	The engine room	.15	1.50	3.20	.22	.48
10	Ballast for heeling (pigs)	Symmetrically on the deck along the sides	1.54	3.15	− .90	4.85	− 1.39
	Total:		12.91			28.38	+14.73 − 4.77
						Total:	+ 9.96

* The columns are filled on the basis of either full-scale measurement, or general arrangement plan.

11. There were missing cargoes during the test.

Table 2

Missing cargoes

No.	Cargo	Position of cargo	Weight, *t*	Arms: distance above the base line, *m*	Arms: distance forward (+) aft (—) of amidships, *m*	Moments: M_z *tm*,	Moments: M_x *tm*,
1	2	3	4	5	6	7	8
1	Steel towing rope	On the deck, forward of the towing arc.	.46	3.23	0	1.49	0
2	Chain of the starboard bower	Chain locker.	.87	.98	9.95	.85	8.30
	Total		1.83			2.34	8.30

12. Determination of the moments of shifting (running) and heeling moments.

Table 3

Heeling moments

Observation No.	Position and weight of cargo, *t*: port	Position and weight of cargo, *t*: starboard	Weight of the ballast shifted (running persons), *t*	The arm of shifting from port to starboard (+), from starboard to port (—)	Moment of shifting (running) (4) × (5)	Heeling moment (sum (6) from the top): (—) to port, *tm*	Heeling moment (sum (6) from the top): (+) to starboard *tm*
1	2	3	4	5	6	7	8
1	.385 .375	.393 .391	0	0	0	0	0
2	.375	.385 .393 .391	.385	+ 3.56	+ 1.37	—	1.37
3	0	.375 .385 .393 .391	.375	+ 3.56	+ 1.33	—	2.70
4	.375 .391	.385 .393	.375	— 3.56	— 1.33	—	1.37
5	.385 .375	.393 .391	.385	— 3.56	— 1.37	0	0
6	.393 .385 .375	0 .391	.393	— 3.56	— 1.40	1.40	—
7	.391 .393 .385 .375	0	.391	— 3.56	— 1.39	2.79	—
8	.393 .385 .375	.391	.391	+ 3.56	+ 1.39	1.40	—
9	.385 .375	.393 .391	.393	+ 3.56	+ 1.40	0	0

13. Readings of plumb lines[1] (the record of the plumb line readings is given in Tables 4 and 5 which are the forms of the blanks for observation).

Table 4

Observation No.	Plumb line No. 1 Length λ=2960 *mm*, suspended in the fore crew's space Observer ______ (Surname, name and patronymic)											
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Σ	Mean a_i
1	195	205	197	202	193	202	199	201	199	202	2000	200
2	260	276	262	274	265	271	266	270	267	269	2680	268
3	333	339	333	339	334	338	335	337	335	337	3360	336
4	265	271	265	270	266	270	267	270	267	269	2680	268
5	194	198	195	197	195	197	196	196	196	196	1960	196
6	128	132	128	132	129	131	129	131	130	130	1300	130
7	64	70	65	70	65	69	65	68	66	69	671	67
8	131	135	132	135	132	134	132	133	133	133	1330	133
9	201	205	202	205	202	204	203	204	203	203	2032	203

Table 5

Observation No.	Plumb line No. 2 Length λ=3060 *mm*, suspended in the engine room Observer ______ (Surname, name and patronymic)											
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Σ	Mean a_i
1	185	186	184	186	184	186	184	186	184	185	1848	185
2	264	266	264	266	264	266	265	265	265	265	2650	265
3	340	343	341	343	341	343	341	343	341	343	3419	342
4	263	266	264	266	264	266	265	265	264	265	2648	265
5	184	186	185	186	184	186	184	186	185	185	1851	185
6	105	108	106	109	106	108	106	108	106	108	1070	107
7	33	35	33	35	32	35	33	35	33	35	339	34
8	112	116	113	115	113	115	113	114	113	115	1139	114
9	191	197	192	196	193	195	194	195	193	195	1941	194

[1] The table is not filled when the measurements are made by means of inclinograph.

14. Heeling angles (the heeling angles for each observation are computed in Table 6)[1].

Table 6

No.	Plumb line No. 1 λ=2960 mm			$\frac{k_i}{\lambda} = \operatorname{tg}\theta_i = \frac{k_i}{2960}$	Plumb line No. 2 λ = 3060 mm				(5) + (9)	Mean
	Plumb lines readings a_i, mm	Mean initial 1/3 $(a_1+a_5+a_9)$, mm	Divergence $k_i = a_i - (3)$, mm		Plumb lines readings a_i, mm	Mean initial 1/3 $(a_1+a_5+a_9)$, mm	$k_i = a_i - (7)$, mm	$\frac{k_i}{\lambda} = \operatorname{tg}\theta = \frac{k_i}{3060}$		$\operatorname{tg}\theta = \frac{1}{2}(10)$
1	2	3	4	5	6	7	8	9	10	11
1	200	200	—	0	185	188	—	0	0	0
	268	200	68	.0230	265	188	77	.0252	.0482	.0241
	336	200	136	.0460	342	188	154	.0503	.0963	.0481
	268	200	68	.0230	265	188	77	.0252	.0482	.0241
	196	200	—	0	185	188	—	0	0	0
6	130	200	— 70	—.0236	107	188	— 81	—.0265	—.0501	—.0250
7	67	200	—133	—.0440	34	188	—154	—.0503	—.0952	—.0476
8	133	200	— 67	—.0226	114	188	— 74	—.0242	—.0468	—.0234
9	203	200	—	0	194	188	—	0	0	0

Note: The positive value of tg θ corresponds to the list to starboard, the negative one — to port.

[1] When the measurements are made by means of Amayeff inclinograph, the Table is replaced by inclinogram.

15. Calculation of the displacement on the Bonjean scale (carried out in Table 7).

Table 7

Frame No. forward and aft of amidships	Frame area		Sum	Difference	Product
	fore ω_f	aft ω_a	$\omega_f+\omega_a$	$\omega_f-\omega_a$	(1) × (5)
1	2	3	4	5	6
0	8.85	—	8.85	0	0
1	8.85	8.85	17.70	0	0
2	8.62	8.81	17.43	—.19	—.38
3	8.24	8.50	16.74	—.26	—.78
4	7.65	8.06	15.71	—.41	—1.64
5	6.94	7.26	14.20	—.32	—1.60
6	5.97	6.24	12.23	—.27	—1.62
7	4.78	5.09	9.87	—.31	—2.17
8	3.36	3.81	7.17	—.45	—3.60
9	1.77	2.08	3.85	—.31	—2.79
10	0	0	0	0	0
Σ			123.75		—14.58
Correction			0		0
Corrected Σ			123.75		—14.58

The frame spacing over the whole length is equal to:

$$\Delta L = 1.234 \ m.$$

The volume of displacement without appendages:

$$V = 1.234 \cdot 123.75 = 152.5 \ m^3.$$

The displacement tonnage with appendages taken into account

$$D = k\gamma V = 1.006 \cdot 1.00 \cdot 152.5 = 153.2 \ t.$$

The distance of the centre of buoyancy from amidships

$$X_c = -1.234 \frac{14.58}{123.75} = -.15 \ m.$$

16. The calculation of the metacentric height under conditions of the test (carried out by the method of minimum squares, Table 8).

The probable absolute error of the test

$$\varepsilon = \pm\sqrt{\frac{\Sigma\varepsilon_i^2}{n(n-1)}} = \pm\sqrt{\frac{\Sigma\varepsilon_i^2}{6 \cdot 5}} = \pm\sqrt{\frac{483 \cdot 10^{-6}}{30}} =$$

$$= \pm .004 \ m,$$

where n — is the number of observations, when the ship is in inclined position (not in initial position).

The relative error of the test in %

$$\frac{\varepsilon}{h} = \frac{.004}{.375} \cdot 100 = 1.1\%$$

The water-plane square on the basis of the curve of water-plane areas:

$$S = 83 \ m^2$$

The relative error of determination of the displacement in %

$$\frac{\Delta D}{D} \cdot 100 = \frac{\gamma S \Delta T}{D} \cdot 100 = \frac{1.83 \cdot .005}{153.2} \cdot 100 = .3\%$$

Table 8

Observation No.	Heeling moments M_i, tm	tg θ_i	Product $M_i \times \text{tg}\,\theta_i$, tm	$\text{tg}^2\,\theta_i$	$M_i : \text{tg}\,\theta =$ $= (2) : (3)$, tm	Metacentric height of a single test, m $h_i = (6) : D$	Error of a single test, $\varepsilon_i\ h_i - h$	ε_i^2
1	2	3	4	5	6	7	8	9
1	0	0	0	0	—	—	—	—
2	1.37	.0241	.0330	5.80×10^{-4}	56.8	.371	.004	16×10^{-6}
3	2.70	.0481	.1300	23.10×10^{-4}	56.1	.366	.009	81×10^{-6}
4	1.37	.0241	.0330	5.80×10^{-4}	56.8	.371	.004	16×10^{-6}
5	0	0	0	0	—	—	—	—
6	—1.40	—.0250	.0350	6.25×10^{-4}	56.0	.366	.009	81×10^{-6}
7	—2.79	—.0476	.1330	22.70×10^{-4}	58.6	.383	—.008	64×10^{-6}
8	—1.40	—.0234	.0327	5.45×10^{-4}	59.8	.390	—.015	225×10^{-6}
9	0	0	0	0	—	—	—	—
	Sum		.3967	69.10×10^{-4}	—	—	—	483×10^{-6}

The metacentric height under test conditions:

$$h = \frac{\Sigma(4)}{D\,\Sigma(5)} = \frac{.3967}{153.2 \times 6.91} \times 10^3 = .375\ m$$

Note. Table 8 is not filled when using the Amayeff inclinograph.

but in accordance with the accuracy of determination on the basis of the line drawing, assume:

$$100 \cdot \frac{\Delta D}{D} = 1\,\%.$$

The error of the metacentric formula:

$$100 \cdot \frac{\Delta h}{h} = 1\,\%.$$

The error of ballast weighing

$$100 \cdot \frac{\Delta P}{P} = 1\,\%.$$

The error of measurement of the shifting arms:

$$100 \cdot \frac{\Delta l}{l} = .5\,\%.$$

The full relative possible error of the test

$$100 \cdot \frac{\delta h}{h} = 100\left(\frac{\varepsilon}{h} + \frac{\Delta h}{h} + \frac{\Delta D}{D} + \frac{\Delta P}{P} + \frac{\Delta l}{l}\right) =$$
$$= 1.1 + 1.0 + 1.0 + 1.0 + .5 = 4.6\,\%.$$

The full absolute possible error of the text

$$\delta h = h\frac{\delta h}{h} = .375 \cdot .046 = \mp .017\ m.$$

The height of the transverse metacenter above the base line according to the curves of the ordinates of the center of buoyancy [1]

$$z_m = 2.84\ m.$$

The height of the centre of gravity above the base line

$$z_g = z_m - h = 2.84 - .37 = 2.47\ m.$$

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[1] When the ship has a trim, the height $z_{m\psi}$ of the transverse metacenter above the base line under the test conditions should be determined with due regard for change of both items forming the formula for $z_{m\psi}$

$$z_{m\psi} = z_{c\psi} + r_\psi.$$

The transverse metacentric radius r_ψ with due regard for the trim is calculated on the basis of the line drawing, on which the actual waterline is drawn, using the formulae:

$$r_\psi = \frac{I_{x\psi}}{v};\quad I_{x\psi} = \frac{2}{3}\Delta L \Sigma y_\psi^3,$$

where $I_{x\psi}$ — the transverse moment of inertia, calculated on the basis of the line drawing;
y_ψ — the ordinate of the actual waterline;
ΔL — the theoretical spacing;
r_ψ — the transversal metacentric radius.

The value of the ordinate of the centre of buoyancy $z_{c\psi}$ is determined from the formula

$$z_{c\psi} = z_c + \Delta z_c,$$

where: z_c — the ordinate of the centre of buoyancy corresponding to the mean draught of the ship and taken directly from the curve;
Δz_c — the correction taking into account the trim of the ship,

17. Determination of the centre of gravity and metacentric height position when the ship is in light condition.

Table 9

No.	Cargo	Position of the cargo	Weight P, t	Arms, m		Moments in ton-metres	
				distance from base line, z	distance from amidships, x	M_z	M_x
1	2	3	4	5	6	7	8
1	Ship under test conditions	—	153.2	2.47	—.15	378.0	— 23.0
2	Surplus cargoes		12.91			28.98	+ 9.96
3	Missing cargoes		1.33			2.34	+ 8.30
	Light ship		141.6	2.49	—.17	352	— 24.7

Note. The abscissa of the centre of gravity of the ship under test conditions is accepted equal to that of her centre of buoyancy, determined on the Bonjean scale.

The height of the metacenter above the base line (taken on the basis of the hydrostatic curves) $z_m = 2.81$ m.

The transverse metacentric height

$$h = z_m - z_g = 2.81 - 2.49 = .32 \ m.$$

The mean draught on the basis of the displacement curve:

$$T_{mean} = 2.39 \ m$$

18. Determination of the centre of gravity and metacentric height when the ship is fully laden.

Table 10

No.	Cargo	Position of the cargo.	Weight P, t	Arms, m		Moments, tm	
				distance from base line, z	distance from amidships, x	M_z	M_x
1	Ship in light condition	—	141.6	2.49	-- .17	352.0	—24.7
2	Crew of 10 persons	On deck	1.04	4.10	0	4.9	0

$$\Delta z_c = \frac{1}{2} R_\psi \psi^2 .$$

In this formula:

ψ — the angle of the trim in radians;

R_ψ — the longitudinal metacentric radius

$$R_\psi = \frac{I_{yf\psi}}{V}; \quad I_{yf\psi} = 2\left(\frac{L}{2p}\right)^3 \Sigma x^2_\psi y_\psi - S_\psi x^2_{f\psi},$$

where: p — the number of ordinates counted forward and aft of amidships;

$I_{yf\psi}$ — the moment of inertia of the actual waterplane;

S_ψ — the actual waterplane area;

$x_{f\psi}$ — the abscissa of its centre of gravity;

y_ψ and x_ψ — the ordinates of the actual waterplane and multiplicators corresponding to their abscissae.

All these values are determined on the basis of the line drawing for a given trim of the ship. The value of $z_{c\psi}$ may be also determined by means of especially computed integral curves of static moments of the frame areas against the base line.

Table 10 continued

No.	Cargo	Position of the cargo	Weight P, t	Arms, m		Moments, tm	
				distance from base line, z	distance from amidships, x	M_z	M_x
3	Machine oil in tanks	On deck, in way of engine hatch	0.46	3.52	−3.20	1.6	−1.5
4	Boiler water	In double bottom tanks	2.30	0.23	−2.80	.5	−6.5
5	Wash water	Tank	.43	0.23	−.84	.1	−.4
6	Drinking water	Tank	.20	5.82	+.83	1.2	+.2
7	Provisions	Provision room	.06	4.60	−1.45	.3	−.1
8	Fuel	In bunkers	17.40	2.28	−.15	39.7	−2.6
		The ship is fully laden	163.5	2.45	−.22	400.3	−35.6

The height of the metacenter above the base line (on the basis of hydrostatic curves):

$$z_m = 2.86\ m$$

The transverse metacentric height

$$h = z_m - z_g = 2.86 - 2.45 = .41\ m.$$

EXTRACTS FROM LOAD LINE RULES FOR SEA-GOING SHIPS

§ 39. Hatch coamings. The height of hatchway coamings on freeboard deck shall be at least 610 *mm* above the deck. The height of coamings on superstructure deck shall be at least 610 *mm* above the deck if situated within a quarter of the ship's length from the stem and at least 460 *mm* if situated elsewhere.

Coamings shall be of steel, substantially constructed and where required 610 *mm* high, shall be fitted with efficient horizontal stiffener placed not lower than 255 *mm* below the upper edge, and fitted with efficient brackets or stays from the stiffener to the deck, at intervals of not more than 3 *m*. Where end coamings are protected, the requirements may be modified on approval of the Register of the USSR.

§ 40. Hatchway covers. Covers to exposed hatchways shall be efficient. The wood hatchway covers shall be at least 60 *mm* thick in association with hatch beams spaced not more than 1.5 *m*.

The width of each bearing surface for these hatchway covers shall be at least 65 *mm*.

§ 41. Hatchway beams and fore-and-afters. Where wood hatchway covers are fitted the hatchway beams and fore-and-afters, as regards construction, scantlings and spacing, shall satisfy the Rules for Construction and Classification of sea-going steel vessels, issued by the Register of the USSR, depending on the height of coamings, prescribed by these Rules.

§ 42. Carriers or sockets. Carriers or sockets for hatchway beams and fore-and-afters shall be of steel at least 12.5 *mm* thick and shall have a width of bearing surface of at least 75 *mm*.

§ 43. Cleats. Strong cleats at least 65 *mm* wide shall be fitted on the hatchway coamings at intervals of not more than .6 *m* from centre to centre; the end cleats shall be placed not more than 150 *mm* from each corner of the hatchway.

§ 44. Battens and wedges. Battens and wedges shall be efficient and in good condition.

§ 45. Tarpaulins. At least two tarpauling in good condition shall be provided for each hatchway in an exposed position on freeboard and superstructure decks. The material of the tarpaulins shall be guaranteed free from jute, shall be of standard weight and proper quality.

§ 46. Security of hatchway covers. At all hatchways in exposed positions on freeboard and superstructure decks ring bolts or other fittings for lashings shall be provided.

Where the breadth of the hatchway exceeds 60 per cent of the breadth of the deck in way of the hatchway, and the coamings are required to be 610 *mm* high, fittings for special lashings shall be provided for securing the hatchway covers after the tarpaulins are battened down.

§ 48. Hatchway coamings and closing arrangements. Cargo, coaling and other hatchways in the freeboard deck within superstructures which are fitted with Class 2 closing appliances (See § 71) shall have coamings at least 230 *mm* in height and closing arrangements as effective as those required for exposed cargo hatchways whose coamings are 460 *mm* high (§ 39—46).

Where the closing appliances are less efficient than Class 2, the hatchways shall have coamings at least 460 *mm* in height, and shall have fittings and closing arrangements as effective as those required for exposed cargo hatchways.

§ 49. Machinery space openings in exposed position on freeboard and raised quarter decks. Such openings shall be properly framed and efficiently enclosed by steel casings of ample strength and where the casings are not protected by other structures, their strength shall be considered especially. Doors in such casings shall be of steel, efficiently stiffened, permanently attached and capable of being closed and secured from both sides. The sills of openings shall be at least 610 *mm* above the freeboard deck and at least 460 *mm* above the raised quarterdeck. The height of the sill is accepted from the top of deck plating.

Fiddley, funnel and ventilator coamings shall be as high above the deck as is reasonable and practicable. Fiddley openings shall have strong steel covers permanently attached in their proper positions.

§ 50. Machinery space openings in exposed positions on superstructure decks other than raised quarter decks. Such openings shall be properly framed and efficiently enclosed by strong steel casings. Doors in such casings shall be strongly constructed, permanently attached, and capable of being closed and secured from both sides.

The sills of the openings shall be at least 380 *mm* above the deck plating.

Fiddley, funnel and ventilator coamings shall be as high above the deck as is reasonable and practicable. Fiddley openings shall have strong steel covers permanently attached in their proper positions.

§ 51. Machinery space openings in the freeboard desk within superstructures fitted with closing appliances less efficient than Class 1 (See § 70). Such openings shall be properly framed and efficiently enclosed by steel casings. Doors in such casings shall be strongly constructed, permanently attached and capable of being securely closed. The sills of the openings shall be at least 230 *mm* above the deck where the superstructures are closed by Class 2 closing appliances and at least 380 *mm* above the deck where the closing appliances are less efficient than Class 2 (See § 71).

§ 56. Cargo and coaling ports, etc. Openings in the sides of ships below the freeboard deck shall be fitted with watertight doors or covers which, with their securing appliances, shall be of sufficient strength.

§ 58. Side scuttles. Side scuttles to spaces below the superstructure deck of superstructures closed by Class 1 or Class 2 closing appliances (§ 70 and 71), shall be fitted with efficient inside deadlights. Such deadlights shall be permanently attached upon hinges in their proper positions and shall be of such construction so that they can be effectively closed and secured watertight.

Where, however, such spaces in superstructures are appropriated to passengers, other than steerage passengers, or to crew, the side scuttles may have portable deadlights stowed adjacent to the side scuttles, so that they can be readily put in place and closed at all times of service, as stated above.

The side scuttles and deadlights shall be of substantial construction, approved by the Register of Shipping of the USSR.

The scuttles in end bulkheads of the superstructures or in the watertight doors shall be of such strong and efficient construction and have such closing appliances as indicated above, in this paragraph.

§ 68. Enclosed superstructure. Detached superstructures are regarded as enclosed only where:

(*a*) the enclosing bulkheads are of efficient construction (See § 69);

(*b*) the access openings in these bulkheads are fitted with Class 1 or Class 2 closing appliances (See § 70 and 71);

(*c*) all other openings in sides or ends of the superstructure are fitted with efficient watertigth means of closing;

(*d*) means of access to crew, machinery, bunker and other working spaces within bridges and poops are at all times available when the bulkhead openings are closed.

§ 69. Superstructure bulkheads. For ships with minimum freeboard the bulkheads at exposed ends of poop, bridges and forecastle of standard height are assumed to be of efficient construction where the thickness of plating scantlings of stiffeners and end connections thereof comply with the requirements of the Rules for construction and classification of sea-going vessels, issued by the Register of Shipping of the USSR, or the platings, stiffeners and their end connections are of equivalent strength to that required by the Rules.

Class 1 and Class 2 Appliances for closing access openings in bulkheads at ends of detached superstructures

§ 70. Class 1 closing appliances. Such appliances shall be constructed of steel and the whole structure shall be of equivalent strength to the unpierced bulkhead. They shall be permanently and strongly attached to the bulkhead and shall be weathertight when closed. The means for securing these appliances shall be permanently attached to the bulkhead or to the appliances and the latter shall be so arranged that they can be closed and secured from both sides of the bulkhead or from the deck above. The sills of the access openings shall be at least 380 *mm* above the deck.

§ 71. Class 2 closing appliances. The following closing appliances shall be of the Class 2:

(*a*) Strongly framed hard wood hinged doors, which are not more than .76 *m* wide and not less than 50 *mm* thick;

(*b*) Shifting boards fitted for the full height of the opening in channels riveted to the bulkheads, the shifting boards being at least 50 *mm* thick where the width of opening is .76 *m* or less, and increased in thickness at the rate of 25 *mm* for each additional 380 *mm* of width;

(*c*) Portable plates of equal efficiency with the appliances specified in (*a*) and (*b*).

Temporary Appliances for closing openings in superstructure decks

§ 72. Temporary closing appliances for middle line openings in the deck of an enclosed superstructure shall consist of:

(*a*) a steel coaming not less than 230 *mm* in beight efficiently riveted to the deck;

(*b*) hatchway covers as required by § 40, secured by hemp lashings;

(*c*) hatchway supports as required by § 42.

Extracts from Provisional Freeboard Rules for small ships of less than 80 *t* gross tonnage

§ 21. Air pipes from under-deck spaces shall have detachable parts above the deck.

The deck connections (coamings) on which the detachable part of the pipe is put shall be substantially constructed and efficiently connected to the deck.

The ship shall be provided with appliances (seals, etc.) for tight and efficient closing the openings of the connection after the upper part of the pipe is removed in case of stormy weather. The height of the deck connections (coamings) of the air pipes shall be at least 300 *mm*. In protected positions on the deck this height may be reduced to 200 *mm*.

The shutter type ventilators on the decks of deckhouses and superstructures shall be also provided with arrangements for tight and efficient closing; the mushroom and similar ventilators capable of being tightly closed from inside the accommodation space are permitted to be fitted.

§ 22. **Companionways** in exposed positions on the deck shall be of substantial construction and the doors in such companionways shall be capable of being efficiently and tightly closed. The companionways which are not exposed to sea waves are permitted to be provided with wood hinged door not more than 760 *mm* wide. Where the companionway is from .6 to 1.2 *m* high, it is permitted to be fitted with a folding door, provided that the door and hatch cover are capable of being efficiently and tightly closed. Such doors shall be tested for spraytightness.

The coamings of the companionways shall be at least: 300 *mm* high for the doors leading to engine and boiler rooms as well as for all doors exposed to sea waves and 200 *mm* high for other doors.

All the doors shall be opened outwards to the weather decks.

Note. The doors of the companionways which are opened to the sides of the ship and exposed to wave strokes shall be arranged at not less than .6 *m* distance from the side and are permitted only in the aft companionways.

§ 23. **Deck manholes** as well as companionways to spaces other than the living spaces (except engine or motor rooms and cargo holds) shall be provided with strong steel or cast iron covers capable of being permanently closed and secured watertight by means of screw or wedge locking bar or clips. The height of coamings of the manholes and companionways to spaces other than the living spaces is defined depending on the conditions of sufficient and tight closing.

§ 24. **Cargo hatchways** in exposed positions on the deck of a small ship shall have strong coamings at least 300 *mm* above the deck for ships of Category 3 and 400 *mm* for ships of Category 2.

§ 25. **Closing arrangements of cargo hatchways** in exposed positions of the deck shall be efficient and have the following thickness:

steel covers (flat) — at least 4—5 *mm*;

wood covers — 40 *mm* in association with a span of not more than 100 cm;

in cases of greater spans the thickness shall be increased accordingly.

The width of each bearing surface for these wood hatchway covers shall be at least 65 *mm*.

The closing arrangements of cargo hatchways shall be provided with battens and other effective means for securing depending on the type of the cover (stell, wood).

At least one tarpaulin in good condition shall be provided for each cargo hatchway. The tarpaulins may be not provided where the closing arrangements are so constructed and secured that they can be effectively closed watertight. Such construction of the closing arrangements of hatchways, in particular when steel corrugated covers are fitted, shall be especially approved by the Register of Shipping of the USSR.

§ 26. **Skylights** in exposed positions on the deck of a small ship shall be of strong construction with hinged covers capable of being secured watertight. Scuttle glasses in the covers shall be round, at least 6 *mm* thick, securely and tightly fitted in the covers.

The height of each skylight coaming above the upper surface of the deck shall be in exposed positions at least:

500 *mm* — for engine and boiler skylights;

400 *mm* — for the remainder of skylights in ships of Category 2;

300 *mm* — for the remainder of skylights in ships of Category 3.

Where the height of the skylights is less than that stated, the skylights

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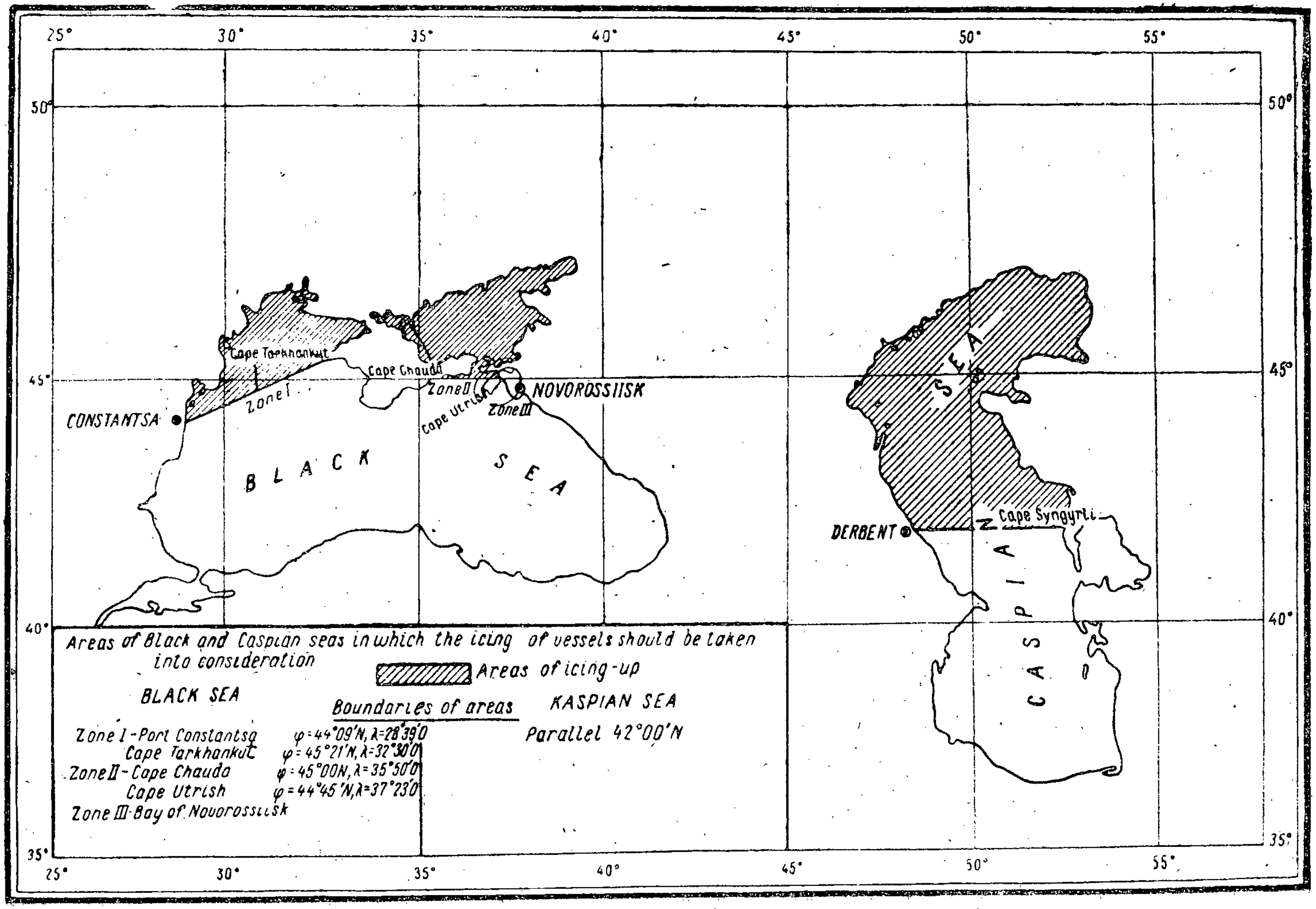

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are not permitted to be provided with opening covers, except cases, when these skylights are arranged in superstructure, deckhouse or engine casing.

The height of superstructure, deckhouse or engine casing in these cases shall be not less than 350 *mm* above the upper deck of the ship. The height of the skylight coaming shall be at least 150 *mm* above the upper surface of the deck of the superstructure, deckhouse or engine casing.

§ 29. Superstructures extending from side to side of the ship (sunk forecastle, poop, and bridge) may be included in reserve buoyancy of the ship (See § 42), provided that the strength of the superstructure corresponds to that of the ship's hull.

The strong end bulkheads in these superstructures are allowed to have only such openings which are fitted with efficient watertight means of closing. Doors fitted in bulkheads of such superstructures shall be of steel and capable of being closed watertight by means of handles attached to the door from both sides. The height of the coaming in this case shall be at least 250 *mm*. The door shall be fitted only in the bulkheads protected against wave strokes.

The superstructures which do not meet the requirements stated above shall not be taken into account when assigning the freeboard to the ship.

THE PRINCIPLES LAID IN THE BASIS OF ADDITIONAL REGUIREMENTS ON STABILITY OF TUGS

It is known from practice that the casualties of tugs due to loss of stability are caused in most cases by the action of a towline quickly tautened. The whole phenomenon of capsizing develops so impetuously that in majority of cases it is impossible to take proper and prompt measures against the capsizing of the ship. Therefore the cases of the "jerk" of towline shall be considered especially careful.

The jerk of the towline can occur in two different cases: when a tug moves by means of her own propelling installation tightening the towline preliminarily slacken or when a tow moves (under its own momentum, under the action of current or its own propelling power) about the tow boat, the latter may be at the first moment immovable.

The first case occurs, for example, when raising a stranded tow afloat under the action of momentum of the tug. The tug picks up speed with the line being free and slack and then by its inertia and by thrust of propellers produces a dynamical pull of the line, by action of which it is possible sometimes to get the tow afloat again. It may happen while tightening taut the line, whose direction forms with the centre line of the tug a rather large angle so that the projection of dynamical pull on midship plane may create a dangerous heeling impulse moment. An analogous situation can take place when the tug tries to alter sharply the course of the tow by force of the towline pull, the tug in this case can come to the helm circle with a tout or, what is more dangerous, with preliminarily slacked and then quickly tightened towline.

In the second case the tow (vessel) moving under its own momentum, under the action of current, its own propelling power or by pull of other tugs (when towed by several tugs, e. g. when moved out or into a port) tautens the cable preliminarily slack, transferring to the hook of the tug a sufficiently great impulsive jerk power. It can appear in certain cases that the tug at this moment lies athwart to the direction of jerk, then the dangerous heeling impulsive moment will be produced.

As to the external factors, the speed of the tug in relation to the speed of the tow and the angle between the towline and the centre line of the tug in all cases are of decisive importance.

In the first case the greatest heel is produced when the angle formed by the towing cable with the centre line is slightly less than 90°. In the second case, the jerk purely transversal is the most dangerous. The latter has been assumed as a basis when working out the additional requirements for stability of tugs of the new Standards of Stability.

Experience gained in application of Provisional Standards of Stability of sea-going merchant ships and coasters, 1948, issued by the Register of Shipping of the USSR, showed that they have been unsatisfactory as regards checking of stability of tugs for jerk of the towline.

It appeared that a considerable number of tugs, sufficient stability of which was confirmed by the experience gained in their service, did not satisfy the Provisional Standards. Uncovered shortcoming of the Provisional Standards as regards special requirements for stability of tugs arose from the lack of sufficiently right ideas about mechanics of dynamical heel of the vessel under the action of jerk of the towline. The research of the dynamics of ship under the action of jerk of the towline and the project of the new Standards of Stability for tugs were carried out by the Sector of Sea-Going Qualities of the Central Maritime Research Scientific Institute.

It was supposed beforehand that the stability of tugs shall be standardized in two essentially different directions:

1. According to criterion derived from analysis of the dynamics of transverse jerk of the towline.

2. According to criterion derived from analysis of heeling moment when the ship moves with an oblique course in relation to taut towline at an angle which is nearly the right one.

As is obvious from analysis of the forces created when the ship moves at a helm angle with tight towline, the heeling pull of the latter due to the helm force created, can be several times as large as the maximum screw thrust even when the ship steadily moves.

It was supposed previously that this maximum heeling effort is equal to a half of the pull at the towing hook along the centre line of the ship.

An attempt to foresee in the Standards a direct checking of stability when the ship steadily moves, proved to be unsuccessful owing to lack of sufficient amount of experimental materials for computing forces and moments produced under such conditions. These forces and especially moments are sharply changed with alteration of the form of ships. Analysis of dynamics of the oblique jerk of towline when the ship speeds up under

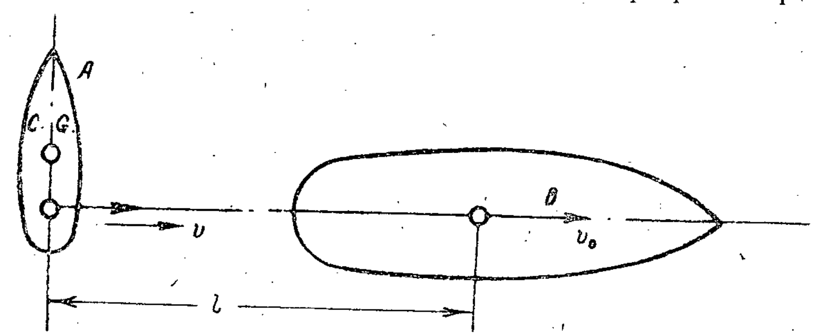

Fig. 1

of the screw action showed that practically all vessels cannot withstand the dynamical heeling action of the jerk when moving by an oblique course to the towline and the angle between the course and the line is nearing the right one. Such conditions may not be assumed, therefore, as a basis of the Standards of Stability; they shall be in no case permitted in the service of tugs.

In order to protect fully the ship from capsizing when she accidentally got under conditions of oblique jerk the use of special arrangements for momentary casting off the towline from the bridge in case of emergency or the use of releasing hooks in tugs should be extended.

Dynamics of the transverse jerk according to the scheme in Fig. 1 was taken as a principle for the Standards. Even when using such simple scheme the dynamics of jerk is proved to be very complex to standardize because the dynamical heel of tug (the tug does not move till the moment of the jerk action) depends on the following external circumstances:

1. Velocity of jerk v, i. e. the speed of movement of the tow in relation to that of the tug.

2. Ratio of the mass of the tow to that of the tug.

3. Length, weight, elasticity and inertia of the towline.

Inclusion into the Standards the influence of length, weight, elasticity and inertia of the towline would extremely complicate the working out of Standards and application of the latter since these factors under conditions of service of the given ship are changable and accidental to a considerable extent. Therefore the influence of such factors from the very outset was not taken into consideration. The heel problem was being solved on assumption that the towline is inponderable problem was being solved on assumption that the towline is inponderable and non-extensive which gives an additional margin of stability. It was being considered the movement of a tug A (Fig. 1) with a mass m under the action of transverse jerk of the towing cable having no weigth, elasticity and inertia. It was supposed that at initial moment the ship A lay without heel and the towline with length equal to l was not tight (the mass of the line is of no importance in this case). Due to movement of the tow B with the mass M (taking into account the added mass of water) in a direction perpendicular to the centre line of the ship A with a certain speed v_0 which is referred to as the velocity of jerk, the towline is tautened and the ship A is carried away and thereby heeling and swinging about vertical axis.

When making the above said assumptions that the line is considered as non-extensive flexible thread devoid of mass, in the mechanical system: the ship A, the tow B and the surrounding water at the moment of tightening the line a non-elastic impact will occur. As a result of this impact the originally stationary point O of suspension of the tow hook as well as the centre of gravity of the ship will obtain momentary acceleration; furthermore, the angular velocities of heel and swing of the ship will be created instantly. The pull of the towline at this moment will be increased by leap to infinity (theoretically), but the impulse of the pull force will be finite.

It is assumed for simplicity that the mass of tow M is very great in comparison with the mass of tug m

$$\left(\mu = \frac{m}{M} \to 0\right).$$

In this case the point of suspension of the tow hook O will instantly get a velocity $v = v_0$ in a direction perpendicular to the centre line of ship and this velocity owing to non-extensibility of the line remains constant during the whole post-impact period. It was also assumed that the angle of divergence of the towline from the normal to centre line remains small during the whole period of movement. As a result of research the approximate equation

$$v = \sqrt{\frac{2\, g l_d}{\mu_{zz}} \frac{(1 + c^2)(1 + c^2 + b^2)}{b}} \qquad (1)$$

connecting the velocity of jerk v (m/sec) with the maximum heeling angle θ (radians) of the tug through corresponding thereto arm l_d (m) of dynamical stability, has been obtained, where:

$g = 9{,}81\ m/sec^2$ — gravity acceleration;

$\mu_{zz} \approx 2\frac{T}{B}$ — is coefficient of added mass of water when the ship moves transversally;

$c = \frac{x_h}{r_{zz}}$ — is relative "dynamical" abscissa of the point of suspension of the tow hook;

$b = \frac{z_0}{r_{zz}}$ — is relative "dynamical" ordinate of the point of suspension of the tow hook;

x_h — is distance between the point of suspension of the tow hook and the centre of gravity of the ship measured on the horizontal in m;

z_0 — is height of the point of suspension of the tow hook above the "central point" in m;

r_{zz} — is radius of inertia of the ship's mass with due regard for inertia of the water mass about the vertical central axis (related to virtual mass of the ship when moving transversally) in m;

r_{xx}— is radius of inertia of the water mass with due regard for inertia of the water about longitudinal central axis (related to virtual mass of the ship when moving transversally in the water), in *m*.

The "central point" denotes the centre of inertia of the ship's mass together with the added mass of water.

Assuming the permissible heeling angle θ, the permissible velocity of jerk v can be computed from the formula (1) preliminaliry determining from the diagram of dynamical stability the value l_d corresponding to the given heeling angle θ. On the contrary, having assumed the velocity of jerk, the arm l_d corresponding thereto can be computed from the formula:

$$l_d = (1 + \mu_{zz}) \frac{v^2}{2g} \frac{b^2}{(1 + c^2)(1 + c^2 + b^2)} \qquad (2)$$

which is obtained by solving the equation (1) in relation to l_d. Then the corresponding heeling angle θ can be determined in the usual way from the diagram of dynamical stability.

Examination of the influence of the tow mass upon dynamical heel in case of jerk enables calculating the decrease of the heeling angle due to finiteness of the tow mass. If the heeling angles from the equation (1) when the mass of a tow is infinitely great and when it is $\frac{1}{\mu} = \frac{M}{m}$ times as large as that of tug, are denoted θ and θ_μ accordingly, then the ratio $\frac{\theta_\mu}{\theta}$ may be calculated from the formula:

$$\frac{\theta_\mu}{\theta} = \sqrt{\frac{(1 + c^2)(1 + c^2 + b^2)}{(1 + c^2 + \mu)(1 + c^2 + b^2 + \mu)}}. \qquad (3)$$

As the formula indicates that the heeling angle in case of jerk reduces with decrease in the tow mass (e. i. with increase of $\mu = \frac{m}{M}$), so the assumption that the tow mass in comparison with the tug mass in infinitely great gives a certain margin of stability in the Standards.

The computations indicate that the correction for influence of the tow mass practically does not exceed 5—10%.

As is evident from schematized examination of the jerk phenomenon, jerk velocity is of decisive importance for producing the heeling impulse. From the values being part of formulae (1) and (2) for determining the maximum heeling angle on the basis of dynamical stability diagram, only the jerk velocity connects the ship with conditions of environment, all other values define own properties of the ship.

Thus, only jerk velocity or a value directly connected therewith may serve as a criterion of the stability in case of jerk.

The velocity of jerk determined for each tug on the basis of dangerous heeling angle and depending on:

a) position of the tow hook along the height and length of the tug;

b) stability characteristics of the tug;

c) tug's inertia properties—can define ability of the tug to withstand the dangerous heeling action of the jerk on one hand, and to some extent service conditions under which the tug operates, on the other hand. The upper limit of possible jerk velocity can be, for example, determined. This upper limit is defined by the speed of towage in smooth water, velocity of the current, velocity of the wind drift or velocity of the cyclic movement in rough water of the tug when it lies along the waves.

To establish the standard of the maximum jerk velocity, the material relating to stability of great number of tugs under different loading conditions has been worked out. The maximum jerk velocity was being calculated from the formula (1) for each tug.

Several attempts have been made to find the magnitude which in the best way suits to be an argument defining the service velocity of the jerk. As a result, the power of the tug was found to be such argument.

The adopted method of standardizing differs essentially from that of Provisional Standards and changes the estimation of stability of the tugs although it is based on certain conditional assumptions. The new method founded on assumed scheme of jerk, is based at the same time on strict mechanical laws and more substantiated physically.

THE PRINCIPLES LAID IN THE BASIS FOR THE STANDARDS OF STABILITY OF FLOATING CRANES

Up to the present there have been no officially adopted and detailed requirements regulating the stability of sea-going floating cranes in the practice of stability assignment both in the USSR and abroad.

There are known, however, individual requirements introduced by some classification societies, e. g. the Polish Register of Shipping, Germanischer Lloyd, DSRK, various shipping administrations as well as the requirements for floating cranes operating on the internal waterways of the USSR.

This is why, while introducing into shipping for the first time the Standards of Stability for Sea-Going Floating Cranes, the Register of Shipping of the USSR considers it necessary for the right understanding and interpretation of particular provisions to bring these PRINCIPLES to the notice of all persons and bodies concerned.

* * *

According to the "Standards of Stability for Floating Cranes", stability of a crane is considered sufficient if it complies with the two conditions as follows:

1) the heeling angles of a crane in operation (that is, with load on its hook and suddenly applied wind pressure) do not exceed the permissible values;

2) the required reserve of stability of a non-working crane (that is, with no load on its hook) is ensured under dynamic action of storm gale.

Thus, the force of wind pressure is of decisive importance in the estimation of stability of floating cranes.

The force in question is also of essential significance when considering the strength of metal crane structures, both floating and other types. The value of wind loading in the structural design of cranes is assigned by the USSR State Standard (ГОСТ 1451—42), the standard data being sufficiently confirmed by the experience obtained in the service of lifting cranes. This is why it was considered expedient to lay the data presented in this Standard as a basis in working out the requirements for stability of floating cranes.

According to the data given in the above Standard, the calculated wind loading upon a crane is divided into:

(*a*) loading in operative condition, that is, with load on the hook, and

(*b*) loading in non-operative condition.

The value of wind pressure for dock and floating cranes in operative condition is as follows:

$$p = 40 \; kg \text{ per } sq\, m.$$

For the cranes in non-operative condition, that is, with no load on hook, the value of the calculated wind pressure is determined from the following formula:

$$p = kq \; kg \text{ per } sq.m, \qquad (1)$$

where k is the coefficient of aerodynamic resistance assumed for different parts of the sail area within the range of

$$k = 1.2 \div 1.4,$$

q — the calculated wind pressure head equal to

$$q = \rho \frac{v^2}{2} \cong \frac{v^2}{16}. \qquad (2)$$

where ρ is mass density of air, $kg.m^{-4} sec^2$;
v — wind velocity, *m/sec*.

The value of the calculated wind pressure head is given in the ГОСТ 1451—42 within the range of 100÷180 *kg* per *sq.m* depending upon height of sail area above the earth or sea surface. Total height of a crane in this case is divided into zones, each 20 *m* high, beginning from the earth. Within each individual zone the calculated pressure head is assumed to be constant and is determined by the ordinates of the zone midpoint.

Total force of the wind pressure acting upon a crane is determined by the formula:

$$p = \sum p_i S_i, \qquad (3)$$

where p_i — calculated wind pressure;
S_i — calculated surface of that particular part of the crane or load sail area which is located in a given zone. For a continuous-sided crane structure the calculated sail area is that restricted by the shape of the crane, while for a lattice structure it is an area restricted by its shape minus the openings between the members.

To calculate stability of a floating crane it is important to know not so much the force of wind pressure, as the aerodynamic moment produced by it. The USSR State Standard No. ГОСТ 1451—42 contains no direct instructions as to a method for determination of the heeling moment, but it can be fixed easily on the basis of the data presented in this Standard.

The wind velocity permissible for carrying out the cargo handling operations is determined by assigning for a crane in operative condition the wind pressure equal to $p=40$ *kg* per *sq.m*. If the mean value of the aerodynamic flow coefficients is $k=1.3$, the wind pressure equal to 40 *kg* per *sq.m.* corresponds to the wind force 6, measured by the Beaufort scale. Maximum velocity of the wind flaw or squall in this case is about 22 *m/sec*, while mean velocity is 10 to 12 *m/sec*.

Different methods of defining the wind loading used in the USSR State Standard ГОСТ 1451—42, that is, in terms of the wind pressure for a crane in operative condition and in terms of the velocity head for a crane in non-operative condition can hardly be considered advisable and may become a source of misunderstanding. It is considered more rational in the calculations of stability to specify the wind loading for both conditions of the crane by means of the velocity head. In this case various parts of the sail area should be considered from the viewpoints of the coefficients of flow, the value of the latter being different for various areas, but which, however, are the same both for the operative and non-operative conditions of the crane.

The standard of the calculated wind pressure head adopted for a floating crane in operative condition is $q=30$ *kg/sq.m*. The wind pressure corresponding with this standard after introducing the coefficients of flow is about $p=40$ *kg/sq.m* which complies with the requirement laid down in the above State Standard.

The value of the velocity head q for a crane in operative condition should be adopted in accordance with the USSR State Standard ГОСТ 1451—42 constant for the entire sail area of the crane. The fact that for a non-operating floating crane the adopted values of the velocity head are different for various zones depending upon their height makes the calculation slightly more complicated; in other words, due to different positions of the boom in and out of operation and because of the load to be lifted the calculations of the sail area and heeling moment should be carried out separately for each of the two conditions and as a result the sail areas obtained will be different.

The heeling moment produced by the effect of the wind flaw depends upon rising of the centre of effort and the crane centre of gravity as well as on position of the resultant of the hydrodynamic inertia and drift resistance forces.

The height of the centre of effort above the coordinate plane for a crane in operation can be determined from the formula as follows:

$$z_n = \frac{\Sigma k_i S_i z_i}{\Sigma k_i S_i}. \tag{4}$$

For a floating crane out of operation the height of its centre of effort should be determined taking into account the difference in the wind head in various zones

$$z_p = \frac{\Sigma k_i S_i z_i q_i}{\Sigma k_i S_i q_i}, \tag{5}$$

where S_i — the sail areas of individual parts of the structure;
z_i — rising of their CG above the coordinate plane;
k_i — aerodynamic flow coefficients;
q_i — the values of wind pressure for different zones of the sail area.

The heeling moment produced by the effect of the wind flaw should be considered as suddenly applied and dynamically acting.

The force of inertia of the crane itself is applied to its centre of gravity which is usually located considerably above the waterline. The resultant of the hydrodynamic inertia and drift resistance forces can be located both above and below the waterline, depending on the ratio of principal dimensions and lines of the pontoon underwater hull, shape of extending parts, variation of the heeling angle, variable drift speed and acceleration, etc.

Determination of a true lever of the heeling moment produced by squall presents a complicated hydrodynamic problem a precise solution of which in conformity with the particular question does not prove its value.

It is more advisable to adopt as an arm of the heeling moment the height of the crane sail area centre above the actual waterplane with the crane in straight position, as it is customary in stability calculation for transport ships.

In this case, when calculating the position of the sail area centre with the aid of the formulae (4) and (5), it is necessary to take for the coordinate plane the actual waterplane with the floating crane at zero heeling, while the values determined by these formulae should be assumed equal to the arm of the heeling moment.

In practical calculations of the heeling moment this assumption eliminates the necessity to calculate the height of the centre of effort altogether, since the value of the unknown heeling moment caused by the wind pressure can be determined directly from the formula as follows:

(*a*) for a floating crane in operative condition:

$$M^{\mathrm{I}}_{heel} = .001\, q \sum k_i S_i z_i \ tm; \tag{6}$$

(*b*) for a floating crane in non-operative condition:

$$M^{\mathrm{II}}_{heel} = .001 \sum k_i S_i z_i q_i \ tm. \tag{7}$$

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Position of the swinging boom of a general purpose crane in operation should be that in the frame plane. Centre of gravity of a load suspended to the crane boom should be assumed as located in the point of the load suspension to the boom.

It should be assumed that the heeling moment acts in the same direction as the moment due to the load taken.

When checking the stability of a floating crane out of operation, it should be assumed that the boom is installed in the crane fore and aft plane as well as turned on board.

Inclination of a working crane due to the wind effect corresponds to normal conditions of the floating crane operation. Therefore, the assigned value of the permissible heeling angle $\theta_{d\,perm}$ should be such as not to impede normal service conditions of a crane. The permissible heeling angle adopted in the Standards is the least of the three values as follows:

1) the heeling angle with which the minimum freeboard of the pontoon is 300 *mm*, taking into account its trim;

2) heeling angle with which the middle of the midship section bilge comes out from water;

3) heeling angle $\theta_{d\,perm}=6°$.

Since the maximum value of total heel produced by the static effect of the load moment, boom and balance weight as well as by the dynamic effect of the wind pressure should not exceed 6°, its determination can be made using the metacentric formula of stability

$$\theta_d = \theta_0 + \frac{57{,}3° \cdot 2M_{heel}}{D\,(r-a)} \text{ degrees,} \tag{8}$$

where θ_0— is static heeling produced by the load moment;
M_{heel}— is heeling moment caused by the wind pressure for a crane in operation;
D— is displacement;
$(r—a)$— is metacentric height.

The second item of the right-hand part of formula (8) determines dynamic heeling caused by the wind pressure. The metacentric height $(r—a)$ should be assumed with due corrections for free surfaces of liquids. However, due to large values of $(r—a)$ amounting for the floating cranes to several metres, it is necessary to take into account only those tanks for which the correction to the metacentric radius exceeds one decimetre (.1 metre).

If the design of the crane boom does not provide for its rotation about the vertical axis, the crane can have no initial heeling. In this case the heel θ_0 in formula (8) should be assumed zero, while dynamic heeling caused by the wind pressure only should not exceed 3°, that is,

$$\theta_{d\,perm} \leqslant 3°.$$

Checking for stability a floating crane in non-operative condition assumes the action of hurricane upon it. Since this can be a very seldom case, the requirements for stability of a floating crane in non-operative condition should provide for its safety against capsizing. The heeling angles produced thereby can exceed their values permissible under operating conditions.

The calculated wind loading upon a crane corresponds to that for which structural strength of the crane boom is checked under hurricane and, to all appearance, cannot be considered as the breaking loading. Under this loading, in certain structural members subjected to the heaviest stresses the permanent strain can just originate. It would be illogical to regard the same wind loading as that capable to cause capsizing of the crane.

Since with the boom positioned in the fore and aft plane the floating crane in non-operative position has no initial heeling, the determination of an appropriate minimum capsizing moment for it can be made using the dynamic stability curve by plotting a tangent to the curve from the origin of coordinates as it is usual done.

In the cases when it is assumed that the swinging boom of a floating crane is turned on board, the crane out of operation can have some initial heeling assumed in the direction of the wind action. In such cases the minimum capsizing moment is determined by the dynamic stability curve, using the method described in detail in the Standards.

To guarantee the safety of a floating crane against capsizing, a coefficient of the conditional reserve of stability is introduced into the Standards equal to:

$$K=\frac{M_{caps}}{M_{heel}}. \tag{9}$$

For a crane in non-operative condition the calculated standard designed to specify the conditional reserve of stability is assumed to be:

$$K \geqslant 2.0. \tag{10}$$

The Standards contain additional requirements for stability of floating cranes providing their passage at a sea or at an ocean. Besides listing a number of arrangements necessary for the safety of a floating crane when passing at a sea or at an ocean, it is recommended in the Standards that the following unequality be satisfied:

$$\frac{M_{caps}}{M_{heel}} \geqslant 1.0,$$

where M_{caps} — is the minimum capsizing moment determined from the dynamic stability curve taking into account the rolling, the amplitude of which for all cranes is assumed $\theta_m=15°$;

M_{heel} — is the heeling moment caused by the wind pressure determined in conformity with the passage conditions according to the plan adopted for a non-operating crane, as specified in the Standards.

The necessity to work out special requirements for stability of crane in its passage has been emphasized by a number of Inspections of the USSR Register of Shipping.

The Standards contain instructions as to the necessity of compiling the "Information on Stability of a Floating Crane" and experimental determination of the position of its centre of gravity.

There are no requirements in the Standards for checking the stability of a floating crane in case of sudden breakaway of the load though these were introduced into the Draft Standards, some USSR State Standards and other documents standardizing the stability of floating cranes. The main reason to exclude these requirements was the data obtained by the Central River Fleet Research Institute in the service behavior studies of a number of floating cranes in case of sudden breakaway of the load handled.

As a result of the tests carried out by the aforesaid Research Institute, rapid attenuation of the crane oscillations and a low dynamic coefficient, exciting no apprehension, were found.

The results of the crane stability calculations in case of the load breakaway which were made in accordance with the requirements laid down in the Draft Standards enable to draw similar conclusions.

The calculations show that even disregarding the damping forces and assuming a hardly probable coincidence of the load breakaway with a wind gust, stability of all the cranes designed is ensured with a large reserve. Therefore, the case of the load breakaway was excluded from the requirements laid down in the Standards.

The Standards of Stability do not contain any requirements to the static stability curve for floating cranes. It is evident that the requirements laid down in § 12, Part I cannot be extended to the floating cranes which are specific for a shorter but higher curve of statical stability. However, at present there is no data that could be used for adopting reasonable restrictions to the curve of stability for cranes. It is likely that there will be no need in such restrictions altogether but this will be proved by the experience gained in the usage of these Standards. The only limitation introduced into the Standards is that it is not obligatory to take into consideration the effect of free surfaces of the liquids when plotting the curves of stability for floating cranes, that is, the correction obtained thereby is negligible in the case of large maximum arms of the curves.

The present Standards have been checked by calculation of the basic types of floating cranes that yielded good results under service conditions and have a load carrying capacity ranging from 1 to 300 tons.

The experience obtained in the usage of these Standards for practical calculations will enable to store additional data on the stability of floating cranes that will enable to make preciser lated editions of these Standards.

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Standards of Stability of Sea-Going Vessels and Coasters (of transport and fishing fleets)

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NOTICE

to the English Edition of the „Standards of Stability of Sea-Going Vessels and Floating Cranes"

Attention is drawn to the following misprints having occured in the text

Page	Line	Printed	Should be
24	14 from above	of paragraph 14.	indication of paragraph 14.
40	22 from below	(bubles)	(bubbles)
50	Table 2, column 4, total	1.83	1.33
50	Table 3, observation No. 4	$\begin{array}{c\|c} & .385 \\ .375 & .393 \\ .391 & \end{array}$	$\begin{array}{c\|c} & .385 \\ .375 & .393 \\ & .391 \end{array}$
66	9 from above	mass	length
66	formula (1)	$\sqrt{\frac{}{\mu_{zz}\ b}}$	$\sqrt{\frac{}{(1+\mu_{zz})\, b^2}}$
67	27 from below	mass in	mass is

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AGREEMENT
between the Register of the USSR and
Lloyd's Register of Shipping

Inspection

1. In any port in which there is a representative of only one of the two societies referred to in the present agreement, the owner or authorised representative of the owner of a vessel classified by a society not represented in this port or district, may apply to the inspector of the other society to conduct a survey of damage to the hull and machinery (with the exception of inspection of damage to cargo), for dock inspection and for recommendations on specific necessary repairs and supervisory procedure on repairs to hull and machinery. For carrying out of other surveys, except the above-mentioned, reciprocal agreements are required between the Chief Directorates of the two classification societies.

Instructions

2. The inspector will conduct a survey in conformity with regular and customary methods and in conformity with the rules of the society which he represents, unless other conditions have been agreed upon previously with the main office of the above societies.

Reports

3. Upon completion of the survey the inspector shall draw up a report in the English language, covering the factual conditions of the examination of parts of the hull and machinery, and shall make appropriate recommendations for retention in class, taking into consideration the results of the survey recommendations. The inspector may likewise extend the date of the operating certificate or load-line and/or safety of navigation equipment and instruments, displacement, classification of the vessel, under the present authorisation of the appropriate administration.

The inspector may also carry out supervision of changes made in equipment for loading grain or the installations affecting the registered capacity of the vessel.

The inspector will refer the inspection report to the main office of his society to be forwarded to the society with which the vessel is registered, and a copy of this report is sent to the vessel.

Verification of Survey

4. Each society reserves its legal right to conduct verification of the survey in connection with the work done by the other society.

List of Inspectors

5. Both societies shall exchange lists of their inspectors and addresses of the places where they have representatives, and shall keep each other informed of any later changes.

Remuneration

6. The society carrying out a survey shall render an itemised bill for charges in conformity with its regular rates. This bill will be paid by the owners of the vessel at whose request the survey was made, or by their representative located in the port where the survey work was done.

7. The present agreement does not restrict at all the development of, nor does it limit any foreign representative from complying with the regulations of the societies.

8. This agreement will enter into force on the date of its publication but it may be subject to modifications by mutual consent.

9. The agreement may be terminated if either of the two signatory societies gives notification in writing six months in advance of the date of termination.

The agreement is drawn up in two copies, both in the Russian and English languages, both texts to have equal force.

Director
Register of the USSR
VV. Rykachev
20 February 1962

President
Lloyd's Register of
Shipping
K. Pelli

U. S. Dept. of Commerce
Maritime Administration
Division of Office Services
Translated by MSH 5 Nov. 1962

ДОГОВОР «А»

МЕЖДУ РЕГИСТРОМ СССР И КЛАССИФИКАЦИОННЫМ ОБЩЕСТВОМ БЮРО ВЕРИТАС О ВЗАИМНОМ ЗАМЕЩЕНИИ ПРИ ОСУЩЕСТВЛЕНИИ НАДЗОРА ЗА ПОСТРОЙКОЙ И ПЕРЕОБОРУДОВАНИЕМ МОРСКИХ СУДОВ

Настоящий Договор заключен между Регистром СССР, г. Ленинград, в лице Виктора ГОЛОВИНА и Константина АЗАРКО, действующих на основании доверенностей, выданных 3 января 1961 года, с одной стороны, и классификационным обществом Бюро Веритас, г. Париж, в лице его президента — Генерального директора Жоржа БУРЖЕС, действующего на основании Устава общества и полномочий, выданных Административным Советом от 15 июня 1960 года, и директора морского отдела Пьера БЛАН, с другой стороны, с целью взаимного замещения в осуществлении надзора за постройкой и переоборудованием морских судов.

Обе стороны договорились о нижеследующем:

§ 1. Взаимные права и обязанности

1. Каждая из Договаривающихся Сторон при наличии поручения другой Стороны обеспечит надзор за постройкой, переоборудованием или реконструкцией судов на класс другой Стороны или на классы обеих сторон, а также контроль материалов и оборудования, предназначенных для этих судов.

2. Объем технического надзора определяется Правилами той Договаривающейся Стороны, класс которой присвоен или должен быть присвоен данному судну.

§ 2. Применение Правил

Каждая из Договаривающихся Сторон при осуществлении надзора за постройкой, переоборудованием или реконструкцией судна руководствуется Правилами той Стороны, класс которой присвоен или должен быть присвоен судну.

При осуществлении надзора за постройкой, переоборудованием или реконструкцией судов на двойной класс каждая Сторона руководствуется требованиями Правил обеих Сторон.

2. Если у Договаривающейся Стороны, осуществляющей надзор, при пользовании Правилами или другими документами другой Стороны возникнут сомнения, то она должна немедленно известить об этом другую Сторону и ожидать ее решения.

3. Практическое осуществление надзора за постройкой, переоборудованием или реконструкцией судов ведется по методам той Стороны, которая этот надзор осуществляет.

§ 3. Согласование технических проектов

Согласование технических проектов осуществляется Стороной, класс которой присваивается судну, и в соответствии с ее Правилами. В случае постройки судна на два класса согласование технического проекта осуществляется обеими Сторонами.

§ 4. Материалы и оборудование

Каждая из Сторон признает сертификаты и другие документы, относящиеся к контролю материалов и оборудования, выданные другой Стороной на основании ее Правил.

§ 5. Классификация и выдача документов

1. Рекомендация о присвоении судну класса и временное классификационное свидетельство выдаются Стороной, осуществляющей надзор за постройкой судов. Присвоение судну класса осуществляется Стороной, на чей класс построено судно.

2. После окончания постройки судна вся документация — сертификаты на материалы и оборудование, акты испытаний и другие документы передаются Стороне, класс которой присваивается судну, и служат основанием для присвоения судну класса.

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§ 6. Обмен документацией

1. Каждая из Сторон передает другой Стороне по экземпляру своих действующих Правил, а в дальнейшем экземпляры всех последующих изданий и изменений этих Правил. При необходимости использования этих Правил в работе инспекторов Договаривающихся Сторон могут быть затребованы дополнительные экземпляры Правил и их изменений.

2. Каждая из Договаривающихся Сторон передает другой Стороне образцы форм своих документов, отпечатки штампов и клейм и своевременно информирует ее о возможных изменениях.

§ 7. Списки представителей

Договаривающиеся Стороны представляют друг другу списки своих представителей, которые могут выполнять работы, указанные в §§ 1, 3 и 5 настоящего Договора. Каждая Сторона имеет право опубликовать фамилии и адреса этих представителей в своих списках.

§ 8. Оплата

Оплата за исполнение работ, указанных в §§ 1, 3 и 5 настоящего Договора, производится непосредственно заказчиком Стороне, выполняющей работы, по ее действующим тарифам.

§ 9. Уведомление о Договоре

Каждая Сторона должна уведомить своих представителей о заключении настоящего Договора.

§ 10. Действие Договора

Настоящий Договор приобретает силу со дня его подписания и действие его не ограничивается каким-либо сроком. Однако каждая из Сторон имеет право расторгнуть Договор в любое время, предупредив об этом другую Сторону не менее, чем за шесть месяцев вперед заказным письмом.

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Работы, начатые и еще не законченные ко дню расторжения Договора, должны быть закончены на условиях, предусмотренных настоящим Договором.

В удостоверение вышеизложенного представители Сторон заключили и подписали настоящий Договор в гор. Париже 11 января 1961 года в двух подлинных экземплярах, каждый на русском и французском языках, причем оба текста имеют одинаковую силу.

От Регистра Союза ССР

В. Головин

К. Азарко

От Бюро Веритас

Ж. Буржес

П. Блан

ДОГОВОР «В»

МЕЖДУ РЕГИСТРОМ СССР И КЛАССИФИКАЦИОННЫМ ОБЩЕСТВОМ БЮРО ВЕРИТАС О ВЗАИМНОМ ЗАМЕЩЕНИИ ПРИ ОСВИДЕТЕЛЬСТВОВАНИЯХ ДЕЙСТВУЮЩИХ МОРСКИХ СУДОВ

Настоящий Договор заключен между Регистром СССР, г. Ленинград, в лице Виктора ГОЛОВИНА и Константина АЗАРКО, действующих на основании доверенностей, выданных 3 января 1961 года, с одной стороны, и классификационным обществом Бюро Веритас, г. Париж, в лице его Президента — Генерального директора Жоржа БУРЖЕС, действующего на основании Устава общества и полномочий, выданных Административным Советом от 15 июня 1960 года, и директора морского отдела Пьера БЛАН, с другой стороны, с целью взаимного замещения при освидетельствованиях действующих морских судов, имеющих класс одной или другой Стороны.

Обе Стороны договорились о нижеследующем:

§ 1. Взаимные права и обязанности

Каждая из Договаривающихся Сторон, по просьбе капитана или владельца судна, имеющего класс другой Стороны, или по непосредственной просьбе другой Стороны, обязана выполнять следующие работы:

а) все виды освидетельствований судов, включая технический надзор за ремонтом, испытания и освидетельствования материалов, судового оборудования, приборов и устройств;

в) выдачу сертификатов и других документов по форме, установленной Стороной, выполняющей работы;

с) продление сроков действия всех сертификатов и свидетельств, выданных другой Стороной.

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Примечание. В случае, если надзор за каким-нибудь судовым оборудованием или устройством не предусмотрен Правилами одной из Сторон, данная Сторона должна оказать содействие в оформлении необходимых документов соответствующими правомочными организациями.

§ 2. Взаимная информация

После выполнения указанных в § 1 настоящего Договора работ, Сторона, проводящая освидетельствование, составляет необходимую документацию на двух языках: на языке своей страны и на английском языке. Первый экземпляр каждого из этих документов выдается капитану судна, а второй экземпляр (также на двух языках) вместе с копией всех актов инспекторов в кратчайший срок пересылается другой Стороне.

§ 3. Применение Правил

Каждая из Договаривающихся Сторон при освидетельствованиях руководствуется своими Правилами. Однако ни одна Сторона не должна предъявлять требований, вытекающих только из своих Правил, могущих вызвать конструктивные изменения судна или установку дополнительного оборудования.

§ 4. Списки представителей

Договаривающиеся Стороны представляют друг другу списки своих представителей, которые могут выполнять работы, указанные в § 1 настоящего Договора. Каждая Сторона имеет право опубликовать фамилии и адреса этих представителей в своих списках.

§ 5. Оплата

Оплата за выполнение работ, указанных в § 1 настоящего Договора, производится непосредственно заказчиком Стороне, выполняющей работы, по ее действующим тарифам.

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§ 6. Обмен документацией

1. Каждая из Сторон передает другой Стороне по экземпляру своих действующих Правил, а в дальнейшем экземпляры всех последующих изданий и изменений этих Правил. При необходимости использования этих Правил в работе инспекторов Договаривающихся Сторон могут быть затребованы дополнительные экземпляры Правил и их изменений.

2. Каждая из Договаривающихся Сторон передает другой Стороне образцы форм своих документов, отпечатки штампов и клейм и своевременно информирует ее о возможных изменениях.

§ 7. Уведомление о Договоре

Каждая Сторона должна уведомить своих представителей о заключении настоящего Договора.

§ 8. Действие Договора

Настоящий Договор приобретает силу со дня его подписания, и действие его не ограничено каким-либо сроком. Однако, каждая из Сторон имеет право расторгнуть Договор в любое время, предупредив об этом другую Сторону не менее, чем за шесть месяцев вперед заказным письмом.

Работы, начатые и еще не законченные ко дню расторжения Договора, должны быть закончены на условиях, предусмотренных настоящим Договором.

В удостоверение вышеизложенного представители Сторон заключили и подписали настоящий Договор в г. Париже 11 января 1961 года в двух подлинных экземплярах, каждый на русском и французском языках, причем оба текста имеют одинаковую силу.

От Регистра Союза ССР	От Бюро Веритас
В. Головин	*Ж. Буржес*
К. Азарко	*П. Блан*

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ДОГОВОР
МЕЖДУ РЕГИСТРОМ СОЮЗА ССР И ЯПОНСКИМ КЛАССИФИКАЦИОННЫМ ОБЩЕСТВОМ НИППОН КАЙДЖИ КИОКАЙ В ОТНОШЕНИИ ТЕХНИЧЕСКОГО НАДЗОРА ЗА ПОСТРОЙКОЙ И ПЕРЕОБОРУДОВАНИЕМ СУДОВ

Регистр Союза ССР (гор. Ленинград) и Ниппон Кайджи Киокай (гор. Токио) договорились о взаимном замещении при осуществлении технического надзора за постройкой и переоборудованием судов в пределах и на условиях, оговоренных ниже.

§ 1. Взаимозамещение

1. Каждая из Сторон от имени другой Стороны по поручению последней осуществляет технический надзор за постройкой или переоборудованием судов, имеющих или могущих получить класс другой Стороны.

2. Настоящий Договор распространяется на освидетельствования и испытания корпуса, главных и вспомогательных механизмов, котлов, электрооборудования и всего другого судового оборудования, приборов и устройств, требуемые Правилами той Стороны, чей класс присваивается судну, исключая освидетельствования частей, не входящих в компетенцию Стороны, класс которой присваивается судну.

§ 2. Применение Правил

1. Осуществляя технический надзор, предусмотренный в § 1 настоящего Договора, действующая Сторона руководствуется Правилами той Стороны, чей класс присваивается судну. В случае, если судну присваиваются классы обеих Сторон, действующая Сторона руководствуется Правилами обеих Сторон.

2. Если у действующей Стороны возникают какие-либо сомнения в отношении применения Правил или требований другой Стороны, то она должна сообщить

об этом другой Стороне для получения соответствующих ее инструкций.

3. Освидетельствования и испытания осуществляются инспекторами действующей Стороны в соответствии с их практикой и методами.

§ 3. Утверждение чертежей и других документов

Утверждение чертежей и других технических документов осуществляется Стороной, класс которой присваивается судну. В случае, если судну присваиваются классы обеих Сторон, утверждение осуществляется обеими Сторонами.

§ 4. Материалы и оборудование

Сертификаты на материалы и оборудование, устройства и снабжение, выданные действующей Стороной в соответствии с ее собственными Правилами, будут признаваться другой Стороной, за исключением случаев особо ею оговоренных.

§ 5. Классификация и сертификаты

1. После окончания постройки или переоборудования судна действующая Сторона выдает на судно временное классификационное свидетельство и другие судовые документы.

2. Две копии указанных выше свидетельств и других необходимых судовых документов, вместе с рекомендацией на присвоение судну класса, должны быть направлены действующей Стороной Стороне, чей класс присваивается судну.

Окончательное присвоение судну класса и выдача классификационного свидетельства осуществляется той Стороной, класс которой присваивается судну.

3. Формы вышеуказанных свидетельств и документов должны быть в соответствии с формами, принятыми той Стороной, класс которой присваивается судну.

§ 6. Совместное освидетельствование

Каждая из Сторон может организовать, если это будет признано необходимым, совместное освидетельствование в период осуществления надзора, при наличии подтверждения Главного Управления другой Стороны.

§ 7. Связь (переписка)

Переписка между обеими Сторонами в основном осуществляется на английском языке через Главные Управления Сторон.

В особо необходимых случаях каждая из Сторон имеет право послать свои указания непосредственно действующей инспекции другой Стороны, но в каждом таком случае она должна информировать об этом Главное Управление этой Стороны.

§ 8. Обмен формами документов

Каждая из Сторон передает другой Стороне образцы форм своих свидетельств, сертификатов и других документов и отпечатки штампов, а также информирует об их изменении. При наличии возможности, то же относится к формам свидетельств, сертификатов и отпечаткам штампов, выдаваемых на суда другими правомочными организациями, осуществляющими надзор за судами.

§ 9. Список представительств

Каждая Сторона передает другой Стороне список своих представительств, которые будут действовать от имени другой Стороны.

Каждая Сторона имеет право опубликовать этот список, как список своих уполномоченных представительств.

§ 10. Оплата

Оплату за выполнение работ, указанных в § 1 настоящего Договора, включая проездные и другие расходы, получает от клиента действующая Сторона, в соответствии с ее собственными тарифами и другими действующими положениями.

§ 11. Уведомление о Договоре

Каждая Сторона должна уведомить свои представительства и другие заинтересованные организации о заключении настоящего Договора.

§ 12. Действие Договора

Согласовано, что настоящий Договор подлежит утверждению со стороны Регистра СССР — Министром морского флота СССР, а со стороны Ниппон Кайджи Киокай — ее Комитетом и Министром транспорта Японии.

Настоящий Договор вступает в силу со дня вышеуказанного утверждения и остается в силе на неограниченный период времени.

Каждая из договаривающихся Сторон имеет право расторгнуть настоящий Договор по письменному об этом заявлению, которое высылается другой Стороне не позднее, чем за шесть месяцев до желаемой даты расторжения Договора.

Работы начатые, но еще не законченные ко дню расторжения Договора, заканчиваются действующей Стороной в порядке, предусмотренном настоящим Договором.

В удостоверение вышеизложенного представители Сторон подписали настоящий Договор в гор. Токио, 7 декабря 1960 года, в двух подлинных экземплярах, каждый на русском и английском языках, причем оба текста имеют одинаковую силу.

От Регистра Союза ССР
Заместитель директора
МАРКАСОВ
Валентин Григорьевич

От Ниппон Кайджи Киокай
Президент
Масао ЯМАГАТА

ДОГОВОР

МЕЖДУ РЕГИСТРОМ СОЮЗА ССР И ЯПОНСКИМ КЛАССИФИКАЦИОННЫМ ОБЩЕСТВОМ НИППОН КАЙДЖИ КИОКАЙ В ОТНОШЕНИИ ОСВИДЕТЕЛЬСТВОВАНИЙ ДЕЙСТВУЮЩИХ СУДОВ

Регистр Союза ССР (гор. Ленинград) и Ниппон Кайджи Киокай (гор. Токио) договорились о взаимозамещении при освидетельствованиях действующих судов в пределах на условиях, оговоренных ниже.

§ 1. Взаимозамещение

1. Каждая из Сторон от имени другой Стороны по поручению последней или по просьбе заинтересованных лиц (капитана или владельца судна) выполняет следующие работы:

a) все виды освидетельствований судов (включая технический надзор за ремонтом), испытания и освидетельствования материалов, судового оборудования, приборов и устройств;

b) выдачу сертификатов и других документов по форме, установленной действующей Стороной;

c) подтверждение действия и продление сроков действия сертификатов и свидетельств, включая классификационные сертификаты, выданные другой Стороной.

Указанное выше относится к судам, подлежащим освидетельствованию другой Стороной или обеими Сторонами.

2. Настоящий Договор распространяется на освидетельствования и испытания корпуса, главных и вспомогательных механизмов, котлов, электрооборудования и других судовых устройств, приборов и оборудования, требуемые Правилами другой Стороны, исключая освидетельствования частей, не входящих в компетенцию другой Стороны.

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§ 2. Применение Правил

Осуществляя освидетельствования, предусмотренные в § 1 настоящего Договора, каждая Сторона обычно руководствуется своими собственными Правилами и Положениями, за исключением случаев, особо оговоренных другой Стороной. При этом, действующей Стороной не должны предъявляться требования, вызывающие конструктивные изменения судна, необходимость замены или установки дополнительного оборудования, приборов или устройств, хотя бы и вытекающие из Правил действующей Стороны.

§ 3. Совместное освидетельствование

Каждая из Сторон может организовать, если это будет признано необходимым, в особых случаях, совместное освидетельствование, при наличии подтверждения Главного Управления другой Стороны.

§ 4. Связь (переписка)

Переписка между обеими Сторонами в основном осуществляется на английском языке через Главные Управления Сторон.

В особо необходимых случаях, однако, каждая из Сторон имеет право послать свои указания непосредственно действующей инспекции другой Стороны, но в каждом таком случае она должна информировать об этом Главное Управление этой Стороны.

§ 5. Акты

Акты освидетельствований, сертификаты и другие документы могут оформляться по формам действующей Стороны на английском языке. Подлинники этих документов выдаются на судно, а две копии каждого документа высылаются другой Стороне в возможно кратчайший срок.

§ 6. Обмен формами документов

Каждая из Сторон передает другой Стороне образцы форм своих свидетельств, сертификатов и других документов и отпечатки штампов, а также информирует об

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их изменении. При наличии возможности, то же относится к формам свидетельств, сертификатов и отпечаткам штампов, выдаваемым на суда другими правомочными организациями, осуществляющими надзор за судами.

§ 7. Список представительств

Каждая Сторона передает другой Стороне список своих представительств, которые будут действовать от имени другой Стороны.

Каждая Сторона имеет право опубликовать этот список, как список своих уполномоченных представительств.

§ 8. Оплата

Оплату за выполнение работ, указанных в § 1 настоящего Договора, включая проездные и другие расходы, получает от клиента действующая Сторона, в соответствии с ее собственными тарифами и другими действующими положениями.

§ 9. Уведомление о Договоре

Каждая Сторона должна уведомить свои представительства и другие заинтересованные организации о заключении настоящего Договора.

§ 10. Действие Договора

Согласовано, что настоящий Договор подлежит утверждению со стороны Регистра СССР — Министром морского флота СССР, а со стороны Ниппон Кайджи Киокай — ее Комитетом и Министром транспорта Японии.

Настоящий Договор вступает в силу со дня вышеуказанного утверждения и остается в силе на неограниченный период времени.

Каждая из договаривающихся Сторон имеет право расторгнуть настоящий Договор по письменному об этом заявлению, которое высылается другой Стороне не позднее, чем за шесть месяцев до желаемой даты расторжения Договора.

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Работы, начатые, но еще не законченные ко дню расторжения Договора, заканчиваются действующей Стороной в порядке, предусмотренном настоящим Договором.

В удостоверение вышеизложенного представители Сторон подписали настоящий Договор в гор. Токио, 7 декабря 1960 года, в двух подлинных экземплярах каждый на русском и английском языках, причем оба текста имеют одинаковую силу.

От Регистра Союза ССР	От Ниппон Кайджи Киокай
Заместитель директора	Президент
МАРКАСОВ *Валентин Григорьевич*	*Масао ЯМАГАТА*

СОГЛАШЕНИЕ МЕЖДУ РЕГИСТРОМ СОЮЗА СОВЕТСКИХ СОЦИАЛИСТИЧЕСКИХ РЕСПУБЛИК И РЕГИСТРОМ КИТАЙСКОЙ НАРОДНОЙ РЕСПУБЛИКИ О ВЗАИМНОМ ЗАМЕЩЕНИИ В ОСУЩЕСТВЛЕНИИ ТЕХНИЧЕСКОГО НАДЗОРА ЗА СУДАМИ

Регистр Союза Советских Социалистических Республик и Регистр Китайской Народной Республики с целью взаимного замещения в осуществлении технического надзора за судами договорились о нижеследующем:

Статья 1

Обе Договаривающиеся Стороны на своей территории, а также в необходимых случаях и за границей, взаимно замещают друг друга в осуществлении технического надзора и классификации судов, имеющих класс другой Договаривающейся Стороны.

Статья 2

Обе Договаривающиеся Стороны представляют друг другу правила, технические инструкции, образцы и бланки судовых документов, действующие тарифы на освидетельствование судов и списки своих филиалов внутри страны и за границей, а также другие относящиеся к правилам технические материалы и информацию.

Статья 3

Обе Договаривающиеся Стороны взаимно замещают друг друга в работах технического надзора за судами, перечисленных в Статье 4 Настоящего Соглашения, в соответствии с правилами той Договаривающейся Стороны, чей класс присваивается судну, или правилами, согласованными Обеими Договаривающимися Сторонами.

Статья 4

Обе Договаривающиеся Стороны взаимно замещают друг друга в нижеследующих работах:

1. Надзор за постройкой, реконструкцией и ремонтом судов;
2. Производство очередных, ежегодных и специальных освидетельствований, без предъявления требований об изменении существующей конструкции судна и дополнительной установки главного оборудования;
3. Надзор за производством судовых материалов, изделий и оборудования;
4. Выдача судовых документов.

Статья 5

Проектно-техническая документация для постройки и реконструкции судов на класс утверждается той Стороной, чей класс присваивается судну.

Статья 6

При выполнении работы по замещению Обе Стороны могут в отношении технических требований незначительно отступать от утвержденной Другой Стороной проектно-технической документации, Правил той Договаривающейся Стороны, чей класс имеет судно, или Правил, согласованных Обеими Сторонами, если такие отступления не будут влиять на безопасность плавания судов, находящихся на них людей и сохранность перевозимых грузов.

В случае, когда при выполнении работы по замещению возникают вопросы, не регламентированные Правилами Обеих Договаривающихся Сторон или согласованными ими Правилами, но входящие в их компетенцию, решения по таким вопросам принимает Сторона, выполняющая работу.

Статья 7

Обе Договаривающиеся Стороны могут принять непосредственно от верфи, конструкторского бюро, капи-

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тана судна, судовладельца или его представителя заявку на выполнение работы по замещению с последующим уведомлением об этом другой Стороны.

Статья 8

Обе Договаривающиеся Стороны после выполнения работ по замещению, перечисленных в пунктах 1, 2 и 3 Статьи 4 Настоящего Соглашения, должны оформлять судовые документы по форме, установленной той Договаривающейся Стороной, чей класс имеет судно, причем Советская Сторона оформляет на китайском и английском языках, а Китайская Сторона — на русском и английском языках, за исключением актов, донесений и шнуровых книг, которые Обе Стороны составляют на русском и китайском языках. Подлинник указанных судовых документов в порядке, установленном Договаривающейся Стороной, чей класс присваивается судну, выдается на судно, а два экземпляра копии направляются в филиал другой Стороны, в котором данное судно состоит на учете. Временное классификационное свидетельство выдается Договаривающейся Стороной, выполняющей работу, а классификационное свидетельство — Договаривающейся Стороной, чей класс присваивается судну.

Статья 9

Обе Договаривающиеся Стороны в процессе выполнения работы по замещению при наличии достаточных обоснований имеют право продлить, возобновить или лишить класса судно другой Стороны с последующим извещением об этом этой Стороны.

Статья 10

Обе Договаривающиеся Стороны получают оплату за работу по замещению непосредственно с верфи, конструкторского бюро, капитана судна, судовладельца или его представителя в соответствии с тарифами, установленными той Стороной, которая выполняет работу.

Статья 11

Настоящее Соглашение вступает в силу со дня его подписания. Каждая из Договаривающихся Сторон мо-

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жет расторгнуть Настоящее Соглашение по письменному уведомлению об этом другой Стороны за 6 месяцев до предполагаемой даты расторжения Соглашения.

Настоящее Соглашение подписано в г. Пекине 7 мая 1962 года в двух экземплярах, каждый на русском и китайском языках, причем оба текста имеют одинаковую силу.

Представитель Регистра Союза Советских Социалистических Республик	Представитель Регистра Китайской Народной Республики
Ю. РЫКАЧЕВ	*СЕ ЧЖУН-ФЭН*

ДОГОВОР

МЕЖДУ РЕГИСТРОМ СССР И КЛАССИФИКАЦИОННЫМ ОБЩЕСТВОМ «ГЕРМАНСКИЙ ЛЛОЙД» О ВЗАИМНОМ ЗАМЕЩЕНИИ ПРИ ОСУЩЕСТВЛЕНИИ ТЕХНИЧЕСКОГО НАДЗОРА ЗА ПОСТРОЙКОЙ И ПЕРЕОБОРУДОВАНИЕМ СУДОВ

Настоящий Договор заключен между Регистром СССР, представленным его директором дипл. инж. **Рыкачевым Ю. В.** и заместителем директора дипл. инж. **Маркасовым В. Г.**, с одной стороны, и классификационным обществом «Германский Ллойд», представленным директором дипл. инж. Юлиусом **Хеймбергом** и директором дипл. инж. **Гербертом Торнером**, с другой стороны, с целью взаимного замещения при осуществлении технического надзора за строительством или переоборудованием судов.

Обе Договаривающиеся Стороны согласились о нижеследующем:

§ 1. Взаимные права и обязанности

1. Каждая из Договаривающихся Сторон имеет право и, при наличии поручения другой Стороны, обязана осуществлять технический надзор за строительством и переоборудованием судов на класс другой Стороны или на классы обеих Сторон (двойной класс).

2. Объем технического надзора определяется Правилами классификации той Стороны, класс которой присваивается судну.

§ 2. Применение Правил

1. При осуществлении надзора за строительством или переоборудованием судов должны применяться Правила постройки и классификации (в дальнейшем именуемые как «Правила») той Стороны, класс которой присваивается судну.

При осуществлении надзора за строительством или переоборудованием судов на двойной класс каждая Договаривающаяся Сторона руководствуется требованиями Правил обеих Сторон.

2. Если у Стороны, осуществляющей надзор за постройкой, при толковании Правил и других документов возникают затруднения или сомнения, то об этом она, как можно скорее, извещает другую Сторону и ожидает ее решения.

3. Практическое осуществление надзора за постройкой и переоборудованием судов ведется по методам той Стороны, которая этот надзор осуществляет.

§ 3. Техническая документация

Согласование технических проектов осуществляется Стороной, класс которой присваивается судну. В случае постройки судна на два класса технический проект согласовывается обеими Сторонами.

Техническая документация для согласования представляется верфью или ее субподрядчиками в 3-х экземплярах на русском и немецком языках и в том объеме, который предусмотрен Правилами соответствующей Стороны.

§ 4. Материалы и оборудование

Каждая из Договаривающихся Сторон признает сертификаты и другие документы, выданные другой Договаривающейся Стороной на испытанные ею по своим Правилам материалы и оборудование.

§ 5. Классификация и судовые документы

1. Рекомендации о присвоении судну класса и временное классификационное свидетельство выдаются Стороной, осуществлявшей надзор за постройкой судна. Присвоение судну класса осуществляется Стороной, на чей класс построено судно.

2. После окончания постройки судна все формуляры, сертификаты на материалы, а также акты ходовых и других испытаний передаются Стороне, класс которой присваивается судну, и служат основанием для присвоения судну класса,

3. Судовые документы, требуемые для получения разрешения на плавание, оформляются Стороной, осуществляющей надзор за постройкой судна, в том объеме, как это предусмотрено Правилами Стороны, класс которой присваивается судну.

§ 6. Обмен образцами форм документов

Каждая из Договаривающихся Сторон передает другой Стороне образцы всех форм документов, а также отпечатки штампов и немедленно информирует об их изменениях. По возможности то же относится к отпечаткам штампов и форм документов, выдаваемым на суда другими правомочными организациями, которые осуществляют освидетельствование судов.

§ 7. Оплата

Оплату за выполнение работ, указанных в § 1 настоящего Договора, согласно своим тарифам и другим положениям об издержках, получает Сторона, осуществляющая надзор за постройкой судна.

§ 8. Уведомление о Договоре

Каждая Договаривающаяся Сторона должна уведомить свои представительства и другие заинтересованные организации о заключении настоящего Договора.

§ 9. Действие Договора

Настоящий Договор вступает в силу со дня подписания. Действие настоящего Договора не ограничивается каким-либо сроком, однако каждая из Договаривающихся Сторон имеет право расторгнуть Договор, сделав об этом письменное заявление. Это заявление высылается заказным почтовым отправлением не позднее чем за шесть месяцев до желаемой даты расторжения Договора. Работы, начатые и еще не законченные ко дню расторжения Договора, заканчиваются в порядке, предусмотренном настоящим Договором.

В удостоверение вышеизложенного представители обеих Сторон подписали настоящий Договор.

Совершено в Ленинграде/Гамбурге в двух подлинных экземплярах, каждый на немецком и русском языках, причем оба текста имеют одинаковую силу.

Ленинград, 17 ноября 1961 г.	Гамбург, 18 августа 1961 г.
РЕГИСТР СССР	ГЕРМАНСКИЙ ЛЛОЙД
Ю. Рыкачев, В. Маркасов	*Ю. Хеймберг, Г. Торнер*

ДОГОВОР

МЕЖДУ РЕГИСТРОМ СОЮЗА ССР И РЕГИСТРОМ СУДОХОДСТВА ЛЛОЙДА

Освидетельствования

1. В любом порту, в котором представлено только одно из двух Обществ, упомянутых в настоящем Договоре, владелец или полномочный представитель владельца судна, классифицированного Обществом, не представленным в этом порту или соответствующем районе, может обратиться к инспектору другого Общества для проведения освидетельствований повреждений корпуса и механизмов (за исключением освидетельствований порчи грузов), доковых освидетельствований и за рекомендациями по определению необходимого ремонта и проведению наблюдения за ремонтом корпуса и механизмов. Для осуществления других освидетельствований, кроме вышеупомянутых, требуется взаимная договоренность Главных Управлений двух указанных Обществ.

Правила

2. Инспектор будет проводить освидетельствование в соответствии с обычно применяемыми методами и в соответствии с Правилами Общества, которое он представляет, если только другие условия не будут предварительно согласованы Главными Управлениями обоих Обществ.

Донесения

3. По окончании освидетельствования инспектор выдает акт на английском языке, отражающий фактическое состояние осмотренных частей корпуса и механизмов, и представляет соответствующую рекомендацию о

продлении класса, принимая во внимание результаты проведенного освидетельствования. Инспектор может также продлить срок действия свидетельств о грузовой марке и о безопасности по судовому оборудованию и снабжению, выданных стороной, классифицировавшей судно, при наличии полномочий соответствующей Администрации.

Инспектор может также осуществлять надзор за производимыми изменениями в устройствах для погрузки зерна, или за изменениями, влияющими на регистровую вместимость судна.

Инспектор направляет акт освидетельствования в Главное Управление своего Общества для пересылки его Обществу, классифицирующему судно, и экземпляр этого акта передает на судно.

Подтверждающие освидетельствования

4. Каждое Общество сохраняет за собой право потребовать проведения подтверждающего освидетельствования в отношении работ, выполненных другим Обществом.

Списки инспекторов

5. Оба Общества будут обмениваться списками своих инспекторов и адресами местных представительств, а также информировать друг друга о последующих изменениях.

Оплата

6. Общество, осуществляющее освидетельствование, взимает полностью в свою пользу плату в соответствии с установившейся практикой этого Общества. Эта плата и расходы будут выплачиваться судовладельцем, от которого поступила просьба об освидетельствовании, или его представителем, находящимся в порту, где произведено освидетельствование.

7. Настоящий Договор нисколько не ограничивает развитие и не сокращает заграничные представительства любого из указанных Обществ.

8. Настоящий Договор вступает в силу со дня его

подписания, однако он может подвергаться изменению по взаимному согласию.

9. Договор может быть расторгнут любым из двух указанных Обществ путем письменного уведомления об этом за шесть месяцев до даты расторжения.

Договор составлен в двух экземплярах, каждый на русском и английском языках, причем оба текста имеют одинаковую силу.

Директор
Регистра Союза ССР
Ю. Рыкачев

20 февраля 1962 г.

Председатель
Регистра Судоходства
Ллойда
К. Пелли

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РЕГИСТР СССР

ТАРИФЫ
НА РАБОТЫ, ВЫПОЛНЯЕМЫЕ РЕГИСТРОМ СССР

1961

ИЗДАТЕЛЬСТВО «МОРСКОЙ ТРАНСПОРТ»
ЛЕНИНГРАД

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Тарифы пересчитаны в соответствии с Постановлением Совета Министров СССР от 4 мая 1960 г. № 470

РАЗДЕЛ I

ТАРИФЫ НА РАССМОТРЕНИЕ ТЕХНИЧЕСКИХ ПРОЕКТОВ МОРСКИХ И РЕЙДОВЫХ СУДОВ

ТАРИФ 1

на рассмотрение технических проектов по корпусной части

Наименование типов и валовая регистровая вместимость	Стоимость рассмотрения техпроекта в рублях
1. Грузо-пассажирские суда	
до 80 рег. *т*	30
от 81 » 600 » »	60
» 601 » 2000 » »	83
» 2001 » 4000 » »	110
» 4001 » 5000 » »	135
свыше 5000 рег. *т*	150
2. Грузовые суда	
до 600 рег. *т*	47
» 601 » 2000 » »	65
» 2001 » 4000 » »	83
» 4001 » 5000 » »	94
свыше 5000 рег. *т*	100

Наименование типов и валовая регистровая вместимость	Стоимость рассмотрения техпроекта в рублях
3. Прочие суда	
Ледоколы до 4000 *и. л. с.*	91
» от 4001 до 15 000 *и. л. с.*	146
Буксиры до 400 *и. л. с.*	44
» свыше 400 *и. л. с.*	58
Баржи несамоходные грузоподъемностью до 500 *т*	36
Баржи несамоходные грузоподъемностью свыше 500 *т*	45
Шаланды самоходные	58
» несамоходные	42
Плавкраны грузоподъемностью до 50 *т*	35
Плавкраны грузоподъемностью свыше 50 *т*	52
Земснаряды	62
Суда промысловые до 100 рег. *т*	25
Суда промысловые до 400 рег. *т*	42
Суда промысловые свыше 400 рег. *т*	72
Доки до 5000 *т*	101
» свыше 5000 *т*	130
Катера	21

Примечания. 1. За рассмотрение проектов композитных судов тариф повышается на 25%, железобетонных судов — на 20%, наливных судов — на 25%, смешанной постройки (клепка и сварка) — на 10%.

2. За рассмотрение проектов судов с парусным вооружением тариф повышается: при полном вооружении на 10%, при частичном вооружении на 5%.

3. За рассмотрение проектов корпусов, спроектированных из материалов, не предусмотренных правилами Регистра СССР, тариф повышается на 20%.

4. Китобойные матки, плавфабрики, плавмастерские и другие подобные суда приравниваются к тарифам грузо-пассажирских судов (п. 1).

5. За рассмотрение предварительных (эскизных) проектов взимается плата в размере 35% от стоимости рассмотрения технического проекта.

6. За рассмотрение проектов перестройки, переоборудования и капитального ремонта судов взимается плата, исходя из настоящего тарифа 1, но с пониженным процентом, в зависимости от процентного соотношения объема представляемого на заключение Регистра СССР проекта к объему полного технического проекта постройки по корпусной части.

7. За рассмотрение рабочих чертежей, разрабатываемых проектирующими организациями под наблюдением Регистра СССР на основе проекта, рассмотренного последним, взимается плата в размере 1% от стоимости разрабатываемых чертежей.

8. Валовая регистровая вместимость для судов, не имеющих точного подсчета, определяется по следующей приближенной формуле:

$$\frac{L \times B \times H \times \delta}{2{,}83} \text{ рег. т.},$$

где L — рег. длина судна, *м*;
B — рег. ширина судна, *м*;
H — рег. высота борта, *м*;
δ — коэффициент полноты водоизмещения; при отсутствии такового принимается $\delta = 0{,}65$ для самоходных судов, $\delta = 0{,}85$ для несамоходных судов, а также для судов технического флота (земснаряды, плавкраны и др.).

Для судов, имеющих надстройки, к валовой регистровой вместимости, определяемой по указанной выше формуле, прибавляется объем надстроек, вычисляемый по формуле:

$$\frac{l \times b \times h}{2{,}83},$$

где l; b; h — соответственно длина, ширина и высота надстройки в метрах.

9. Объем материалов технического и эскизного проектов устанавливается действующими Правилами Регистра СССР.

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ТАРИФ 2

на рассмотрение технических проектов по механической части

Мощность главных механизмов в индикаторных *л. с.* — 1*HP*	Стоимость рассмотрения техпроекта в рублях
1. Механическая часть технического проекта судна:	
до 100	23
» 200	28—50
» 500	34
» 1000	40
» 2000	47
» 3000	52
За каждую *л. с.* свыше 3000	+0,005
2. Проект паровой поршневой машины мощностью:	
до 100	8
» 150	13
» 200	18
» 500	26
» 800	31
» 1200	36
свыше 1200	42
3. Проект двигателя внутреннего сгорания:	
до 100	11
» 200	21
» 500	31
» 1000	34
» 2000	39

Мощность главных механизмов в индикаторных *л. с.* — 1*HP*	Стоимость рассмотрения техпроекта в рублях
до 2500	42
» 3500	47
свыше 3500	55
4. Проект судовой турбины:	
до 300	13
» 800	36
» 1200	42
свыше 1200	52
5. Паровой котел:	
пов. нагрева до 200 $м^2$	13
» » свыше 200 $м^2$	16
6. Воздухохранитель (один или группа однотипных)	5
7. Холодильная установка на рефрижераторном судне	26
8. Углекислотная противопожарная установка	18

Примечания. 1. Для судов специального назначения, с повышенным количеством, по сравнению с обычным транспортным судном, вспомогательных механизмов, тариф п. 1 должен быть увеличен на 10%.

2. При рассмотрении проектов совершенно новых конструкций механизмов стоимость работ определяется по фактически затраченному времени из расчета 1 руб. 30 коп. в час.

3. Примечания 5, 6, 7 и 9 тарифа 1 являются действительным и для тарифа 2.

4. Индикаторная мощность двигателей внутреннего сгорания и турбин определяется умножением эффективной их мощности на коэффициент 1,25.

ТАРИФ 3

на рассмотрение проектов по электрооборудованию

Наименование	Тариф в рублях
1. Суда не электрифицированные	
Электростанция для освещения мощностью до 10 *квт*	13
То же до 25 *квт*	18—20
То же до 100 *квт*	26
То же до 300 *квт*	31—20
2. Суда электрифицированные (электромеханическое оборудование)	
Суммарная мощность генератора и приемников тока до 100 *квт*	20—80
То же до 300 *квт*	26
» » 500 »	31—20
» » 1000 »	41—60
» свыше 1000 »	52
3. Электроходы (проект электродвижения судна)	
Суммарная мощн. генераторов и гребных электродвигателей до 100 *квт*	31—20
То же до 500 *квт*	46—80
» » 1000 »	62—40
» » 3000 »	93—60
» » 5000 »	106—60
Суммарная мощность генераторов и гребных электродвигателей до 10 000 *квт*	122—20
То же до 20 000 *квт*	135—20
» » 30 000 »	145—60
свыше 30 000 »	156

Наименование	Тариф в рублях
4. Электрооборудование слабого тока	
(телефон, пожарная и аварийная сигнализация и пр.)	
до 10 точек	5—20
» 25 »	7—80
» 50 »	10—40
» 100 »	13
» 300 »	15—60
» 500 »	20—80
» 1 000 »	23—40
» 3 000 »	26
» 5 000 »	28—60
» 10 000 »	31—20
5. Размагничивающее устройство «РУ»	
Длина судна до 80 *м*	10—40
» » от 81 до 150 *м*	20—80
» » свыше 150 *м*	31—20

Примечания. 1. Стоимость рассмотрения проекта электрифицированных судов и электроходов слагается из стоимости тарифов электроосвещения и тарифа электромеханической части.

2. За рассмотрение проектов для нефтеналивных судов тариф повышается на 20%.

3. Стоимость рассмотрения рабочих чертежей по электрооборудованию, подлежащих утверждению линейными Инспекциями, исчисляется из расчета 1% от общей стоимости разработки чертежей.

4. За рассмотрение проектов ремонта или модернизации судна взимается плата в соответствии с примечанием 6 тарифа 1.

5. За рассмотрение эскизных проектов взимается 35% от стоимости рассмотрения технического проекта.

6. За рассмотрение технических заданий взимается 25% от стоимости по тарифу 3.

ТАРИФ 4

на рассмотрение проектов по установке радиооборудования на морских судах

Наименование	Тариф в рублях
1. Проект, содержащий полный состав радиооборудования судна 1-й или 2-й группы . .	31—20
2. Проект, содержащий полный состав радиооборудования судна 3-й или 4-й группы . . .	20—80
3. Проект радиооборудования малого судна, не вошедшего в установленные группы . . .	7—80

Примечания. 1. Полным составом радиооборудования следует считать такой состав, который согласно правилам Регистра СССР является обязательным для судна указанной в правилах группы.

2. В случае если в проекте представлен неполный состав радиооборудования, то из тарифа вычитается 5% за каждый отсутствующий вид аппаратуры, как-то: передатчик, приемник, радиопеленгатор, автоаларм, радиолокационное устройство, гидролокационное устройство или трансляционное устройство.

3. В случае если представленный в проекте состав радиооборудования превышает полный состав, то к тарифу прибавляется 5% за каждый сверхкомплектный вид аппаратуры, как-то: передатчик, приемник, радиопеленгатор, автоаларм, радиолокационное, гидролокационное или трансляционное устройство.

4. Проекты по установке отдельных видов аппаратуры следует рассматривать как проекты с неполным составом радиооборудования.

5. Если проект содержит совершенно новый вид радиоаппаратуры, не предусмотренный правилами Регистра СССР, то тариф повышается на 20%. Такой вид аппаратуры должен быть предварительно испытан в лаборатории в условиях, соответствующих нормальной эксплуатации.

6. За рассмотрение эскизных проектов взимается 35% от стоимости, указанной в данном тарифе.

7. За рассмотрение технических заданий взимается 25% от стоимости, указанной в данном тарифе.

РАЗДЕЛ II

ТАРИФЫ НА ТЕХНИЧЕСКИЙ НАДЗОР ЗА ПОСТРОЙКОЙ И РЕМОНТОМ МОРСКИХ И РЕЙДОВЫХ СУДОВ

ТАРИФ 1

на технический надзор за постройкой морских и рейдовых судов

Договорная стоимость постройки судна с полным механическим оборудованием без контрагентских поставок — С в тысячах рублей	Формула начисления
до 20,0	
20,1— 50,0	0,15 тыс. + (С — 20 тыс.) · 0,006
50,1— 100,0	0,33 » + (С — 50 ») · 0,005
100,1— 150,0	0,58 » + (С — 100 ») · 0,004
150,1— 200,0	0,78 » + (С — 150 ») · 0,003
200,1— 500,0	0,93 » + (С — 200 ») · 0,0025
500,1—1000,0	1,68 » + (С — 500 ») · 0,002
1000,1—2000,0	2,68 » + (С — 1000 ») · 0,0015
2000,1—3000,0	4,18 » + (С — 2000 ») · 0,0012
3000,1—4500,0	5,38 » + (С — 3000 ») · 0,001
свыше 4500,0	6,88 » + (С — 4500 ») · 0,0008

Примечания. 1. В тариф на технадзор за постройкой судна включены стоимость наблюдения за постройкой корпуса судна, изготовления и монтажа механизмов, котлов, баллонов, электро- и радиооборудования, производимых на одном заводе-верфи.

Стоимость технадзора за изготовлением механизмов, котлов, полуфабрикатов, испытание материалов и другие работы, производимые инспекторами Регистра СССР на заводах-верфях (субпоставщиках), не входят в данный тариф и исчисляются по положению 1 данного раздела.

2. В стоимость технадзора за постройкой входит стоимость обмера судна, расчета грузовой марки и полное оформление всех судовых документов, выдаваемых Регистром СССР.

3. Стоимость технадзора исчисляется от стоимости постройки одного судна и при серийной постройке умножается на общее количество строящихся объектов.

4. При техническом надзоре за постройкой многосерийных судов на одном заводе-верфи тариф снижается:

а) при постройке судов числом 5 и более — на 20%,

б) при постройке судов числом 10 и более — на 30%.

5. В случае постройки судовых корпусов клепаной конструкции тариф понижается на 10%.

ТАРИФ 2

на технический надзор за ремонтом морских и рейдовых судов

При техническом надзоре за ремонтом или модернизацией корпусов, механизмов, котлов, электро- и радиоборудования взимается плата от стоимости ремонта или модернизации в размере:

а)	при договорной стоимости ремонта до	5 000 руб.	1,30%
б)	» » » » »	10 000 руб.	0,95%
в)	» » » » »	20 000 руб.	0,75%
г)	» » » свыше	20 000 руб.	0,55%

Примечания. 1. В тариф включены:

а) согласование окончательной ремонтной ведомости,

б) согласование рабочих чертежей,

в) оформление всех судовых документов, выдаваемых Регистром СССР на элементы судна, подвергающиеся ремонту,

г) испытание материалов, идущих на ремонт, на заводе, производящем ремонтные работы.

В тариф не включена стоимость обмера судна и расчет грузовой марки, которая взимается по тарифам 6 и 7 раздела III.

2. При техническом надзоре за установкой новых или ремонтом имеющихся на судне отдельных видов оборудования по корпусной, механической, электро- и радиочастям плата взимается в соответствии с настоящим тарифом.

ОТДЕЛЬНЫЕ ПОЛОЖЕНИЯ

Положение 1

При техническом надзоре по самостоятельным заказам-договорам за изготовлением механизмов, котлов и другого судового оборудования и материалов взимается плата, руководствуясь следующими тарифами:

1. За освидетельствование и испытание прокатных и штампованных материалов, малоответственных поковок и отливок, полуфабрикатов, цепей, тросов и других изделий для судов взимается плата в размере $^1/_2$% от отпускной стоимости выпускаемой продукции.

2. При надзоре за изготовлением и за испытание отливок, поковок, коленчатых и дейдвудных валов, баллеров, гребных винтов, якорей, якорных цепей и других наиболее ответственных судовых агрегатов взимается плата в размере 1% от отпускной стоимости этих изделий.

3. За рассмотрение рабочих чертежей, испытание материалов и технаблюдение за изготовлением котлов, баллонов и других сосудов, работающих под давлением, взимается плата в размере 0,75% от отпускной стоимости этих сосудов.

При серийном изготовлении указанных сосудов на одном заводе суммарной отпускной стоимостью 5 и более миллионов рублей тариф понижается на 25%.

4. За технадзор за постройкой двигателей внутреннего сгорания плата взимается в размере 0,9% от отпускной стоимости постройки.

При серийной постройке двигателей в количестве 10 шт. и более тариф понижается на 25%.

5. За технаблюдение за постройкой паровых и газовых турбин, поршневых машин, электромоторов и генераторов плата взимается в размере 0,8% от отпускной стоимости выпускаемых машин.

При серийной постройке машин в количестве 12 шт. и более тариф понижается на 20%.

6. За приемку мелких вспомогательных и палубных механизмов взимается плата от суммарной их отпускной стоимости в размере $1^1/_2$%; при изготовлении до 20 механизмов до 1% от

их отпускной стоимости — при серийном изготовлении на одном заводе более 20 механизмов.

7. За технический надзор за изготовлением электро- и радиоприборов и оборудования с предварительным согласованием рабочих чертежей взимается плата в размере 1,25% от отпускной стоимости выпускаемой продукции.

Примечание. За рассмотрение рабочих чертежей на двигатели, указанные в п. 4 и 5, взимается дополнительная плата по п. 7 тарифа 1 раздела I.

Положение 2

Если постройка или ремонт судна, а также отдельного агрегата, изготовляемого по самостоятельному заказу под надзором Регистра СССР, не будет закончен в сроки, указанные в договоре заказчика или завода-строителя с Регистром СССР, то независимо от причин просрочки Регистр СССР продолжает получать плату за каждый месяц просрочки из расчета стоимости надзора за судном или отдельным самостоятельным агрегатом, деленной на первоначальный срок окончания работ.

РАЗДЕЛ III

ТАРИФЫ НА КЛАССИФИКАЦИЮ И ОСВИДЕТЕЛЬСТВОВАНИЕ В ПОРЯДКЕ ТЕХНАДЗОРА МОРСКИХ И РЕЙДОВЫХ СУДОВ

ТАРИФ 1

на освидетельствование корпусов самоходных судов

Валовая регистровая вместимость в рег. тоннах	Первоначальное освидетельствование классифицированных и неклассифицированных судов	Очередные освидетельствования классифицированных судов	Ежегодные освидетельствования классифицированных и неклассифицированных судов
	Стоимость освидетельствования в рублях		
до 50	10	8	5
» 100	12—50	9	6
» 300	15	11	7
» 500	17—50	13	8
» 1 000	20	15	9
» 1 500	24	17	11
» 2 000	27	20	13
» 2 500	30	23	15
» 3 000	34	26	17
» 3 500	38	28	19
» 4 000	42	31	21
» 4 500	46	34	23
» 5 000	50	37	25
» 6 000	53	40	28

Валовая регистровая вместимость в рег. тоннах	Первоначальное освидетельствование классифицированных и неклассифицированных судов	Очередные освидетельствования классифицированных судов	Ежегодные освидетельствования классифицированных и неклассифицированных судов
	Стоимость освидетельствования в рублях		
до 7 000	57	44	31
» 8 000	61	47	34
» 9 000	64	50	37
» 10 000	67	53	40
За каждые 10 рег. т свыше 10 000 рег. т	+0,03	+0,02	+0,02

Примечания: 1. За очередное освидетельствование неклассифицированных судов плата взимается по тарифу на ежегодные освидетельствования с повышением на 20%.

2. Тариф первоначального освидетельствования дан без оплаты обмера и расчета грузовой марки, которые надлежит брать по тарифам 6 и 7.

3. Тариф на освидетельствование наливных и железобетонных судов повышается на 20%.

4. За освидетельствование пассажирских и грузопассажирских судов тариф повышается на 15%.

5. В стоимость тарифа входит полное освидетельствование корпуса, судовых устройств и снабжения, за исключением спасательных шлюпок и устройств для их спуска и грузового устройства, оплата за освидетельствование которых взимается по тарифам 3 и 4.

6. При освидетельствовании корпуса без судовых устройств и снабжения тариф 1 понижается на 25%.

7. За освидетельствование корпуса судна в доке или на берегу тариф повышается на 20%.

8. За освидетельствование корпуса металлического судна в возрасте 27 лет и более и деревянного судна в возрасте 9 лет и более тариф повышается на 25%.

9. Для определения размера оплаты за освидетельствование судов, не имеющих мерительных свидетельств, валовая регистровая вместимость определяется согласно указанию в примечании тарифа 1 раздела I.

10. Для промежуточных значений вместимости тариф определяется путем линейной интерполяции.

11. Для судов, подпадающих под действие нескольких указанных выше примечаний, процентные надбавки и скидки суммируются по отношению к основному тарифу.

ТАРИФ 2

на освидетельствование корпусов несамоходных судов

Валовая вместимость в рег. тоннах	Первоначальные освидетельствования	Очередные освидетельствования	Ежегодные освидетельствования
	Стоимость освидетельствования в рублях		
до 100	9	6—50	4
» 300	10—50	8	5
» 500	12	9	6
» 1000	14	10—50	7
» 1500	17	12	8
» 2000	19	14	9
» 2500	21	16	10—50
» 3000	24	18	12
» 3500	27	20	13—50
» 4000	30	22	15
За каждые 10 рег. *т* свыше 4000 рег. *т*	+0,03	+0,02	+0,02

Примечания. 1. Пункты примечания 2, 3, 5, 7, 8, 9, 10 и 11 тарифа 1 раздела III тождественны для данного тарифа.

2. При освидетельствовании классифицированных судов тариф повышается на 20%.

3. При освидетельствовании парусных судов тариф повышается на 25%.

ТАРИФ 3

на освидетельствование и испытание спасательных шлюпок и устройств для спуска шлюпок

Вид освидетельствования	Весельная шлюпка	Шлюпка с ножным приводом	Моторная шлюпка
	Стоимость освидетельствования в рублях		
1. Освидетельствование одной шлюпки со снабжением . .	1—50	2	2—50
2. Освидетельствование пары шлюпбалок с полным вооружением или иного устройства для спуска шлюпки . . .	1	1	1
3. Освидетельствование и испытание вновь построенной шлюпки с оформлением приемочного свидетельства . .	10	11—50	13
4. Испытание вновь изготовленных шлюпбалок (одной пары) или иного устройства для спуска шлюпки	3	3	3

Примечания. 1. При освидетельствовании и испытании патентованных шлюпбалок тариф повышается на 50%.

2. За выдачу дубликата свидетельства на спасательные средства взимается плата в размере 4 руб.

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ТАРИФ 4

на освидетельствование и испытание судового грузоподъемного устройства

Наименование грузоподъемного устройства	Грузоподъемность до 5 *т* включительно	Грузоподъемность свыше 5 *т*
	Стоимость освидетельствования в рублях	
1. За освидетельствование одной стрелы-лебедки или крана с полным вооружением .	1—20	2
2. За испытание одной стрелы-лебедки или крана на пробную нагрузку	2—50	3—50

Примечание. За оформление и выдачу регистровой книги подъемных механизмов или ее дубликата взимается плата в размере 4 руб.

ТАРИФ 5

на освидетельствование грузоподъемных плавучих и береговых кранов

Грузоподъемность крана в тоннах	Первоначальное освидетельствование с испытанием на пробную нагрузку	Очередное освидетельствование с испытанием на пробную нагрузку	Ежегодное освидетельствование в рабочем состоянии
	Стоимость освидетельствования в рублях		
до 10	10	7—50	4
» 35	20	13	7
» 50	23—50	18	10
» 100	26	21	15
» 200	31	26	18
» 300	40	31	21

Примечание. Данные тарифы предусматривают освидетельствование грузового устройства и вспомогательных механизмов плавучего крана и всего берегового крана. Стоимость освидетельствования корпуса понтона и основного двигателя плавучего крана определяется по соответствующим тарифам на освидетельствование судов.

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ТАРИФ 6

на работы по расчету грузовой марки судна

Валовая вместимость судна в рег. тоннах	Стоимость расчета с выдачей свидетельства о грузовой марке в рублях	Валовая вместимость судна в рег. тоннах	Стоимость расчета с выдачей свидетельства о грузовой марке в рублях
I. Пассажирские и грузо-пассажирские суда		II. Грузовые, технические и спец. назначения суда	
до 80	7—50	до 80	5
» 150	12—50	» 150	10
» 300	19	» 300	15
» 500	21	» 500	17
» 1000	25	» 1000	20
» 2000	31	» 2000	25
» 3000	37—50	» 3000	30
» 5000	44	» 5000	35
» 7000	50	» 7000	40
» 10000 и выше	56	» 10000 и выше	45

Примечания. 1. За производство расчета грузовой марки для нефтеналивного судна или для лесовоза тариф увеличивается на 10%.

2. За производство расчета грузовой марки для серийных судов, совершенно тождественных с типовыми, взимается плата в размере 25% основного тарифа с каждого серийного судна.

3. При отсутствии чертежей, необходимых для расчета грузовой марки и снятия инспектором потребных данных с натуры, стоимость расчета определяется по фактически затраченному времени из расчета 1 руб. 30 коп. в час.

ТАРИФ 7

на работы по обмеру судов и определению вместимости

Тип судна	Длина судна в *м*	Стоимость обмера в рублях	
		по Мурсому	по спец. правилам
I. Пассажирские, грузо-пассажирские и ледокольные суда	до 15	10	—
	» 25	21	9
	» 45	50	17
	» 55	62	20
	» 70	80	27
	» 85	100	33
	» 100	125	42
	» 120	150	50
	» 140	175	60
	» 160	200	67
	» 180	225	75
II. Грузовые, технические и специального назначения суда . .	до 15	8—50	—
	» 25	17	7—50
	» 45	40	15
	» 55	50	17
	» 70	65	22
	» 85	80	27
	» 100	95	32
	» 120	115	38
	» 140	140	46
	» 160	160	53
	» 180	185	62
III. Несамоходные суда	до 25	12	5
	» 45	30	10
	» 55	37—50	12—50
	» 70	50	17
	» 85	60	20
	» 100	70	23

Примечания. 1. При производстве обмера судов одной и той же серии из совершенно тождественных с основным типовым судном взимается плата в размере 20% основного тарифа за каждое серийное судно.

2. При производстве обмера серийных судов, имеющих изменения в расположении надстроек и в помещениях, тариф понижается на 65%.

3. При обмере судов сокращенным способом (цепочкой) тариф понижается на 50%.

4. За выдачу дубликата мерительного свидетельства взамен утерянного или пришедшего в негодность взимается плата в размере 4 рублей.

ТАРИФ 8

на освидетельствование главных и вспомогательных судовых механизмов

Суммарная мощность главных машин, *и. л. с.*	Первоначальное и очередное классификационное освидетельствование с разборкой механизмов	Ежегодное освидетельствование
	Стоимость освидетельствования в рублях	
1. Паровые машины и турбины:		
мощность до 100	8	4
» » 200	10	5
» » 1 000	21	6—50
» » 2 000	28	7—50
» » 3 000	34	8—50
» » 10 000	52	15
За каждые 10 *и. л. с.* свыше 10 000	0,02	0,01
2. Двиг. внутр. сгорания:		
мощность до 100	10	5
» » 200	12	6
» » 1 000	25	7—50
» » 2 000	35	8—50
» » 3 000	42	10
» » 10 000	65	17
За каждые 10 *и. л. с.* свыше 10 000	0,03	0,01

Примечания. 1. В стоимость тарифа включены швартовые испытания; ходовые испытания исчисляются по фактически затраченному времени из расчета 1 руб. 30 коп. в час.

2. Индикаторная мощность турбин и двигателей внутреннего сгорания определяется умножением эффективной их мощности на коэффициент 1,25.

3. За освидетельствование вспомогательных механизмов, включая механическую часть палубных механизмов, взимается плата по 50 коп. за каждый освидетельствованный механизм, мощностью менее 50 *и. л. с.* При мощности вспомогательных механизмов более 50 *и. л. с.* таковая суммируется с мощностью главных двигателей и оплата взимается по тарифу 8.

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ТАРИФ 9

на освидетельствование паровых котлов

Поверхность нагрева котла, $м^2$	Стоимость гидравлического испытания в рублях	Стоимость внутреннего освидетельствования в рублях	Стоимость наружного осмотра в рублях
до 20	2—50	3	1—50
» 50	3	4—50	2
» 100	4	6—50	3
» 200	5—50	10	4
» 300	6—50	12	5
Свыше 300 за каждый $м^2$	0,02	0,03	0,01

Примечания. 1. По данным тарифам взимается плата за освидетельствование одного котла, при освидетельствовании на одном судне двух и более котлов при разовом посещении судна тариф понижается на 20%.

2. За гидравлическое испытание паропровода отдельно от котла взимается 1 руб. 50 коп. и при испытании одновременно с котлом — 1 руб.

3. За оформление и выдачу шнуровой книги котла или ее дубликата взимается плата в размере 6 руб.

4. За выдачу разрешения на установку или перестановку котла с проверкой представленных документов взимается плата в размере 4 руб.

5. При освидетельствовании котла в возрасте 30 лет и более тариф повышается на 25%.

ТАРИФ 10

на освидетельствование и испытание воздухохранителей

За один воздухохранитель	Тариф в рублях
1. Внутреннее освидетельствование	1—30
2. Гидравлическое испытание	1
3. Наружный осмотр	0—60

Примечания. 1. За оформление и выдачу шнуровой книги воздухохранителя или ее дубликата взимается плата в размере 2 руб. 40 коп.

2. Тариф за внутреннее освидетельствование применяется при возможности производства этого освидетельствования, в противном случае применяется тариф наружного осмотра.

ТАРИФ 11

на освидетельствование холодильных установок рефрижераторных судов

Емкость охлаждающих помещений, $м^3$	Первоначальные освидетельствования	Очередные освидетельствования и ежегодные	Полугодовое освидетельствование
	Стоимость освидетельствования в рублях		
до 1000	11	8	5
» 2000	15	11	8
» 4000	20	15	11
» 6000	24	19	15
» 8000	28	23	18
» 10 000	32	27	21
Свыше 10 000 $м^3$ за каждые полные и неполные 1000 $м^3$, но не менее 100 $м^3$	1—50	1—20	1

Примечание. В стоимость освидетельствования по данному тарифу входит:
а) освидетельствование механизмов,
б) » трубопроводов,
в) » изоляции трюмов.

ТАРИФ 12

на освидетельствование и испытание судовых углекислотных противопожарных установок

	Гидравлические испытания	Воздушные испытания	Наружный ежегодный осмотр
	Тариф в рублях		
За одну станцию (баллоны, аппаратура, трубопроводы)	10—50	5—50	4

Примечания. 1. При полугодовом поверочном взвешивании баллонов взимается плата по тарифу «наружного ежегодного осмотра».
2. За оформление и выдачу шнуровой книги углекислотной противопожарной установки или ее дубликата взимается плата в размере 2 руб. 40 коп.

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ТАРИФ 13

на освидетельствование судового электрооборудования

Суммарная мощность электроустановок судна, *квт*	Первоначальные и очередные классификационные освидетельствования	Ежегодные освидетельствования
	Тариф в рублях	
до 10	3	2
» 20	4	2—60
» 50	8	5—20
» 100	16	10—40
» 200	18	13
» 400	21	15
» 700	25	18
» 1000	29	20
» 1500	33	22
» 2000	36	24
За каждые 10 *квт* свыше 2000	0,06	0,04

Примечания. 1. В стоимость тарифа включены швартовые и ходовые испытания.

2. Мощность судового электрооборудования устанавливается по суммированной мощности как всех генераторов тока, так и потребителей тока.

ТАРИФ 14

на освидетельствование судового радиооборудования

Наименование	Первоначальное классификационное или очередное освидетельствование	Ежегодное освидетельствование
	Стоимость освидетельствования в руб.	
1. Полный состав радиооборудования судна 1-й и 2-й группы	20	10—50
2. Полный состав радиооборудования судна 3-й и 4-й группы	8	5
3. Радиооборудование малого судна, не вошедшего в установленные группы	7	4

Примечания. 1. Определение «полный состав радиооборудования» см. примечание тарифа 4, раздел I.

2. В случае если производится освидетельствование неполного состава радиооборудования, то из тарифа вычитается 5% за каждый отсутствующий вид аппаратуры, как-то: передатчик, приемник, радиопеленгатор, автоаларм, радиолокационное устройство или трансляционное устройство.

3. В случае если производится освидетельствование такого состава радиооборудования, который превышает полный состав, то к тарифу прибавляется 5% за каждый сверхкомплектный вид аппаратуры, как-то: передатчик, приемник, радиопеленгатор, автоаларм, радиолокационное, гидролокационное или трансляционное устройства.

4. Освидетельствование отдельных видов аппаратуры следует рассматривать как освидетельствование неполного состава радиооборудования.

5. Если в состав освидетельствуемого радиооборудования входит совершенно новый вид радиоаппаратуры, не предусмотренный правилами Регистра СССР, то к основному тарифу прибавляется 20%.

РАЗДЕЛ IV

ОТДЕЛЬНЫЕ ПОЛОЖЕНИЯ

Положение 1

За специальные освидетельствования, производимые Регистром СССР, а также за работы, не предусмотренные настоящими тарифами, как, например, проверка представленных судовладельцем расчетов, работы, выполняемые в порядке экспертизы, различного рода консультации и др., взимается плата по фактически затраченному времени на выполнение работ из расчета по 1 руб. 30 коп. в час, но не менее 3 руб. 50 коп.

Положение 2

За согласование ремонтных ведомостей и технологических процессов по судам, на которые не имеется договоров с Регистром СССР на технаблюдение за ремонтом, взимается плата по фактически затраченному времени на выполнение этих работ из расчета 1 руб. 30 коп.

Положение 3

За напрасный вызов инспектора Регистра СССР взимается плата в размере 6 руб.

Положение 4

При вызове на освидетельствование или испытания за каждый час ожидания инспектором по причине неподготовленности объекта взимается плата из расчета по 1 руб. 30 коп. в час, но не свыше как за 7 часов.

Положение 5

При следовании инспектора к месту освидетельствования и обратно по вызову судовладельца или завода последние оплачивают сверх платы, установленной тарифами, все путевые и командировочные расходы, согласно положению трудового законодательства о командировках, а также оплачивают затраченное время, более 2 часов в один конец, нахождения в пути инспектора из расчета 1 руб. 30 коп. в час, но не свыше как за 7 часов в сутки.

Данное положение распространяется также на работы, производимые Инспекцией Регистра СССР по постоянному техническому наблюдению согласно договору.

Положение 6

За вызов инспектора для производства работ в нерабочее время или в дни отдыха судовладелец или завод оплачивают надбавку к действующим тарифам в размере 50%.

Положение 7

Настоящими тарифами надлежит руководствоваться при взимании платы за все работы, выполняемые Регистром СССР, на территории Советского Союза.

ОГЛАВЛЕНИЕ

Раздел I

Тарифы на рассмотрение технических проектов морских и рейдовых судов

Раздел II

Тарифы на технический надзор за постройкой и ремонтом морских и рейдовых судов

Раздел III

Тарифы на классификацию и освидетельствование в порядке технадзора морских и рейдовых судов

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Раздел IV

Регистр СССР

Тарифы на работы, выполняемые Регистром СССР, подготовлены к изданию Нормативным отделом ЦПКБ-1 ММФ

Спецредактор *Л. П. Маракушина*

Техн. редактор *Л. П. Дрожжина* Корректор *Е. П. Худякова*

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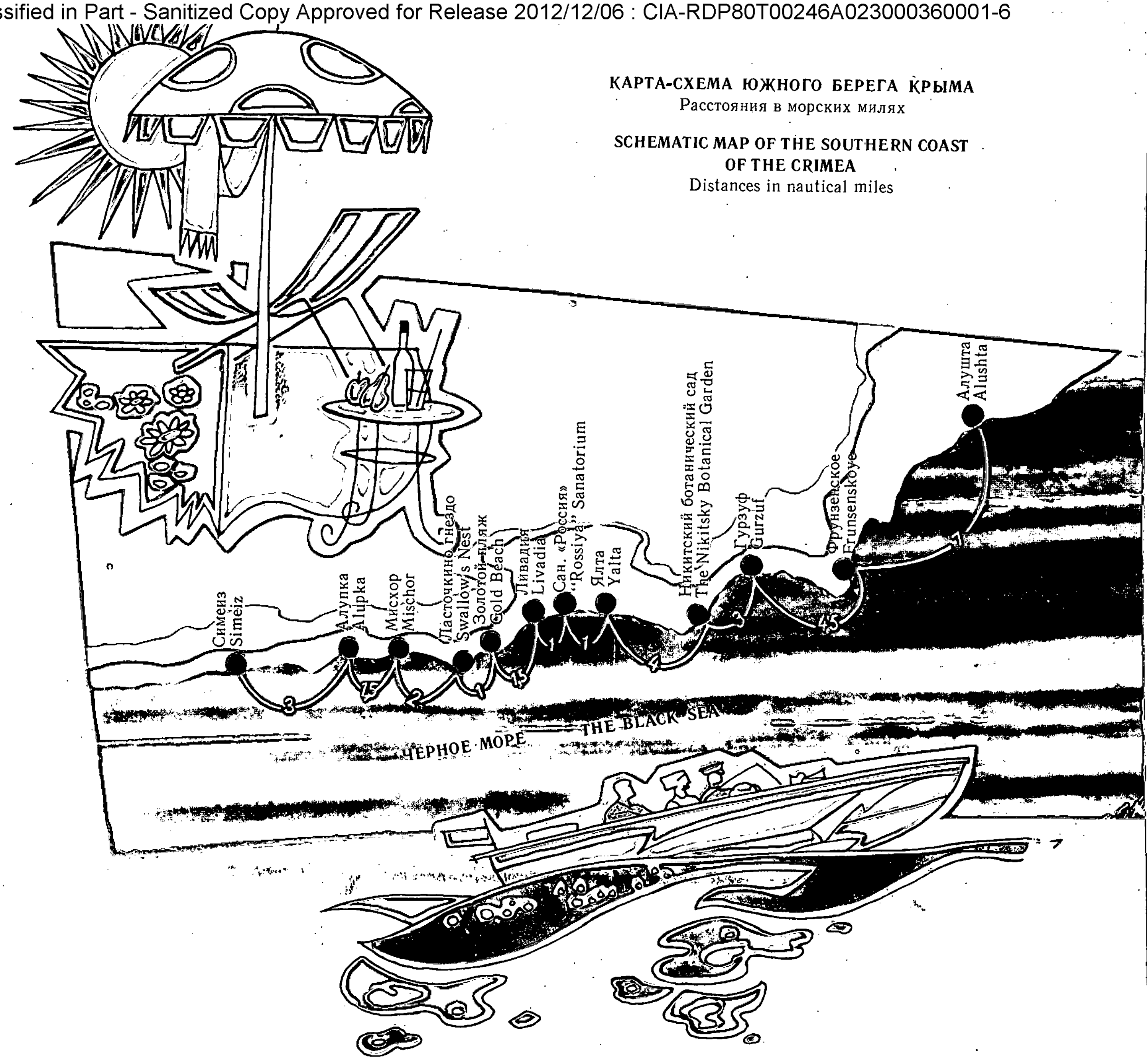
Цена 8 коп.

КАРТА-СХЕМА ЮЖНОГО БЕРЕГА КРЫМА

Расстояния в морских милях

SCHEMATIC MAP OF THE SOUTHERN COAST OF THE CRIMEA

Distances in nautical miles



Даже самого строгого и взыскательного ценителя красоты чарует природа Южного берега Крыма. Глазам туриста, совершающего путешествие вдоль Крымского побережья, открывается величественная панорама, созданная природой и человеком.

Лучше всего знакомство с Крымом начать с Ялты, откуда идут морские дороги ко всем курортам Крымского побережья.

Ялта — всемирно известный курорт и морской порт нашей страны, жемчужина Крыма, раскинувшаяся по живописным склонам горного амфитеатра, обращенного к лазурному морю.

Когда-то здесь отдыхали «сильные мира сего». Для простого человека Ялта была недоступной.

В 1920 году специальным декретом В. И. Ленина Крым был отдан в распоряжение трудящихся, право на бесплатное лечение и отдых которых узаконено Конституцией СССР.

За годы советской власти Ялта стала первоклассной всесоюзной здравницей. В Большой Ялте ежегодно отдыхает около полумиллиона человек.

В прекрасно оборудованных, снабженных современной медицинской аппаратурой и новейшими лечебными средствами санаториях и домах отдыха лечатся и отдыхают советские граждане — строители нового коммунистического общества.

В Ялте можно встретить ткачиху из Москвы и директора Уральского металлургического завода, геолога из Заполярья и шахтера из Донбасса.

The southern coast of the Crimea offers scenic beauties that cannot fail to charm even the most widely-travelled person. As you sail along the coast your eyes meet a magnificent panorama of the handiwork of Nature and man.

The ideal starting point for your discovery of the Crimea is Yalta, world-famous holiday resort and seaport. Called the Pearl of the Crimea, it is picturesquely situated on the slopes of a natural amphitheatre facing the azure sea. From Yalta you can travel by sea to all the beauty spots along the Crimen coast.

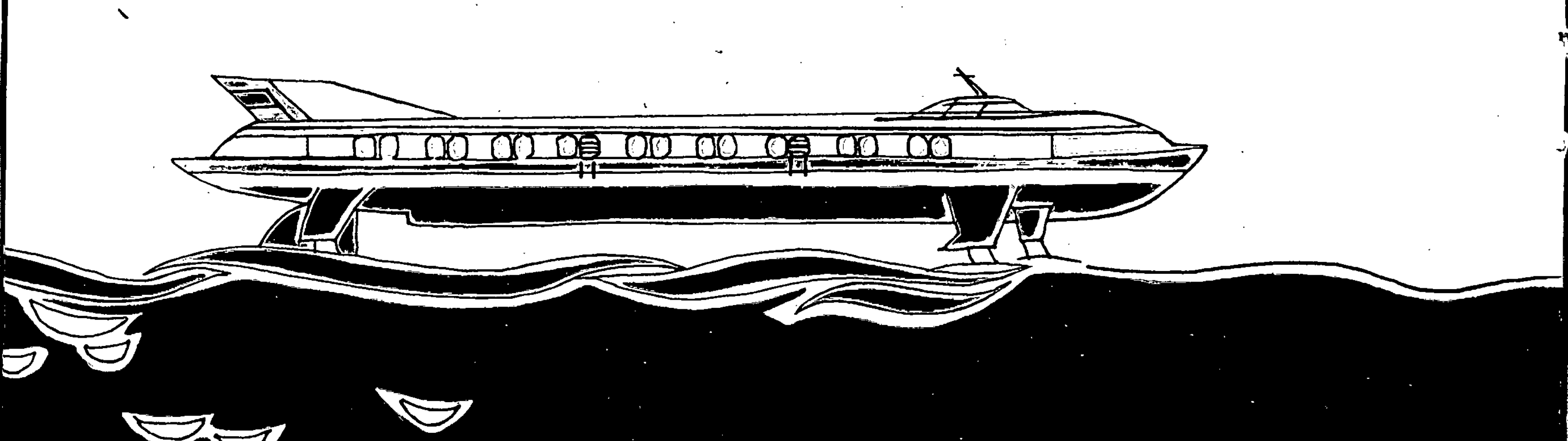
In the old days Yalta was a resort exclusively for the wealthy. No ordinary person could ever afford it.

In 1920 a special decree signed by V. I. Lenin turned over the Crimean resorts to the working people. Under the Constitution of the USSR all citizens have the right to free medical treatment, to rest and leisure.

During the Soviet years Yalta has become one of the country's largest and best resorts. About half a million people spend their holidays here every year.

The guests at the palatial, well-equipped health centres and holiday homes are ordinary Soviet men and women, builders of the new, communist society.

A weaver from Moscow, director of the Ural machinebuilding plant, a geologist from the Arctic region and a miner from the Donbass—in a word, people of all professions spend their holidays in this wonderful resort.



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Общий вид Ялты
A general view of Yalta

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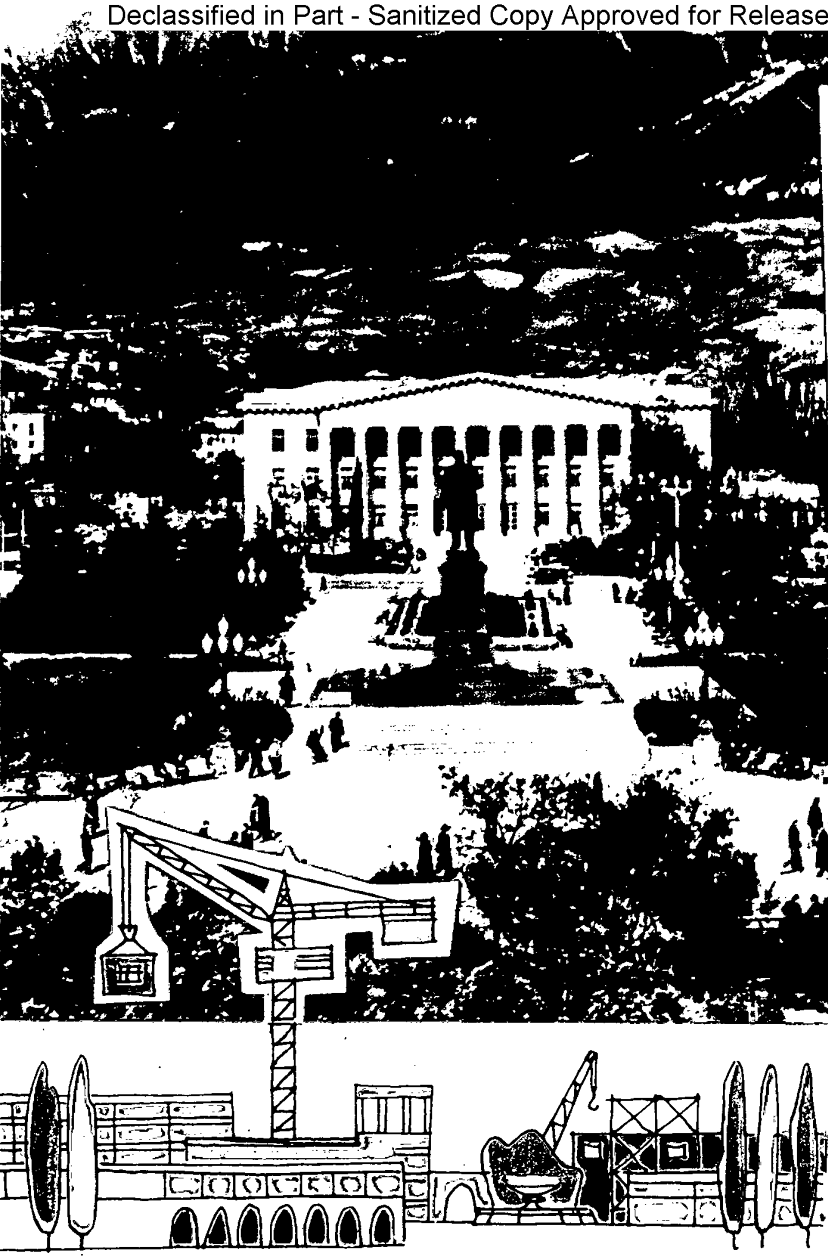


Ялтинский рыбокомбинат
The Fish Factory in Yalta

Ялта. Площадь имени Ленина
Lenin Square, Yalta

В Ялте, как и во всех городах страны, идет большое жилищное строительство. За последние 4 года ялтинцы получили около 100 тысяч квадратных метров жилой площади. В городе появились новые улицы, кварталы и целые районы. Центр переместился к речке Быстрой, где завершается создание архитектурного ансамбля новостроек. Вновь созданные Киевская и Московская улицы соединили Ялту с поселком Ущельное. На пустырях Чайной горки вырос красивый благоустроенный рабочий городок.

До 1965 года будет сдано в эксплуатацию еще 160 тысяч квадратных метров жилой площади.

В Ялте возводятся не только жилые здания. Недавно построенный рыбокомбинат по архитектуре хорошо гармонирует с ансамблем курорта.

Like all the other cities of the Soviet Union Yalta is carrying out a big housing programme. In the past four years it has built housing units with a total floor space of about 100,000 square metres. New streets, blocks and residential districts have sprung up. The central section of the town has shifted to the banks of the river Bistraya, where a large-scale housing development is now nearing completion. Two new thoroughfares, Kiev St. and Moscow St., link up Yalta with the nearby community of Uschelnoye. An attractive modern residential district has arisen on Chainoye Hill.

Housing units with another 160,000 square metres of floor space are to be built by 1965.

But housing is not the only construction going on in Yalta. There is, for example, the Fish Factory, a handsome structure which harmonizes with the whole architectural ensamble of the resort.

Гостиница «Ореанда» для иностранных туристов расположена против городского пляжа, близ Приморского парка. Наши зарубежные гости могут с удобством расположиться в комфортабельных номерах; здесь они найдут все необходимое для отдыха.

В городе есть и другие хорошо оборудованные гостиницы: «Южная», «Украина», «Приморская» и др.

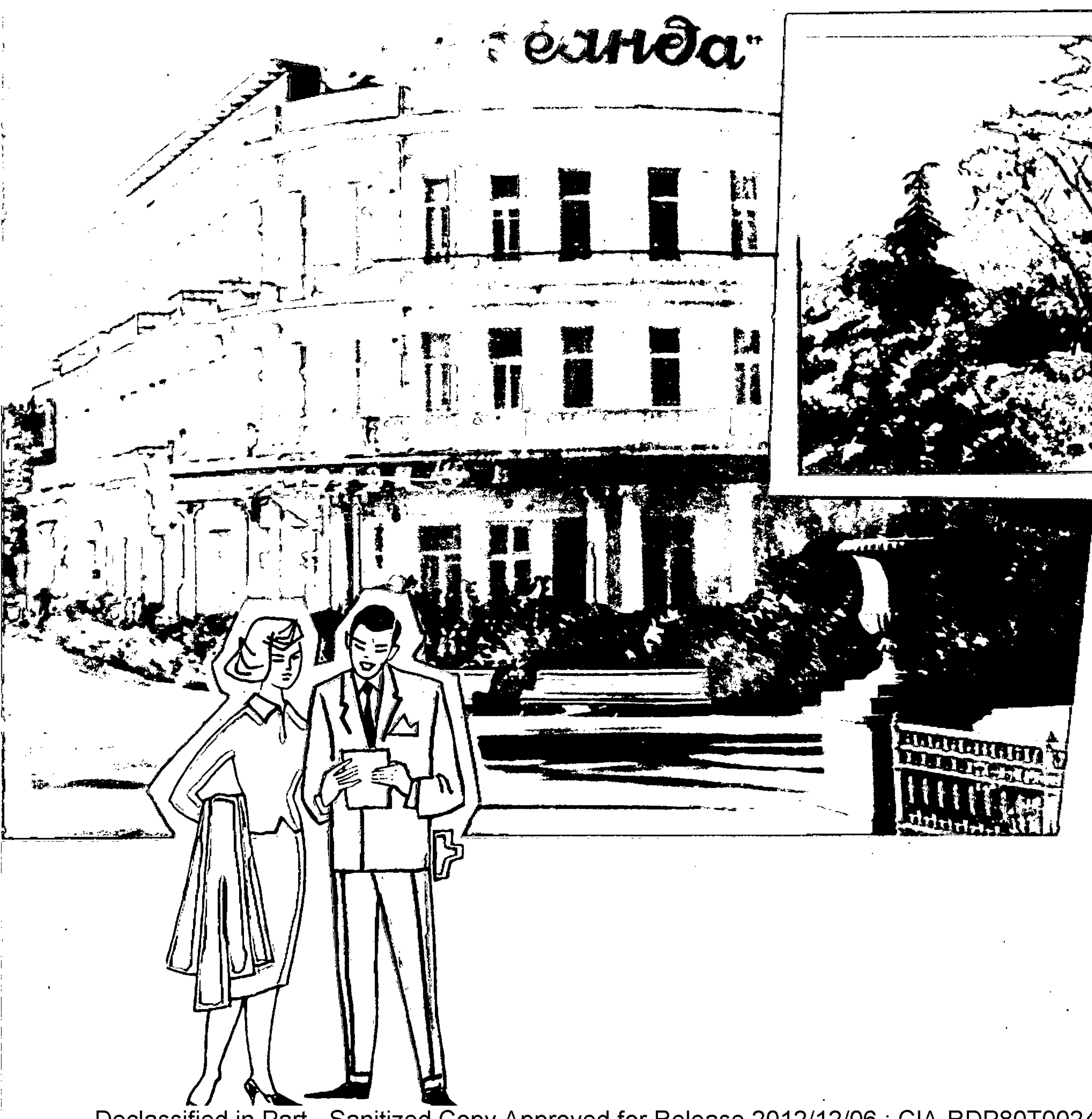
Туристы, приезжающие на своей автомашине, могут не беспокоиться о ее заправке или ремонте. Эти заботы берут на себя работники станции технического обслуживания.

The Oreanda Hotel for foreign tourists overlooks the sea, a stone's throw both from the main beach and from Maritime Park. Here the visitor from abroad will find excellent service and a high standard of comfort.

Yalta has a number of other fine hotels, among them the Yuzhnaya, Ukraina and Primorskaya.

If you come by car, petrol and servicing are no problem. The staff of the local service station will give you quick and competent assistance.

Ялта. Набережная
Yalta. Embankment



Ялта Гостиница «Ореанда»
Oreanda Hotel, Yalta

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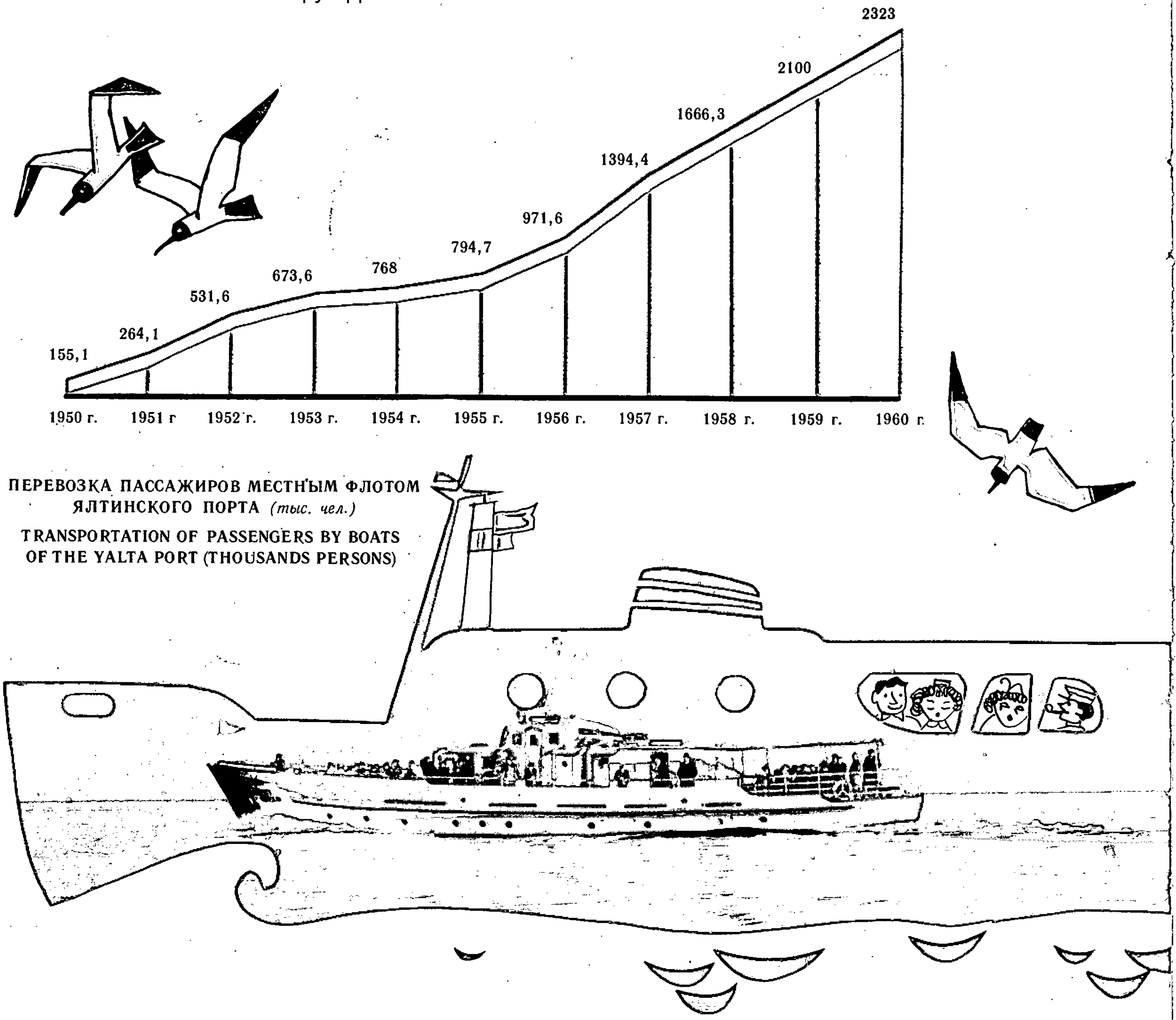


ПЕРЕВОЗКА ПАССАЖИРОВ МЕСТНЫМ ФЛОТОМ ЯЛТИНСКОГО ПОРТА *(тыс. чел.)*

TRANSPORTATION OF PASSENGERS BY BOATS OF THE YALTA PORT (THOUSANDS PERSONS)

По объему пассажирских перевозок порт занимает одно из первых мест в СССР. Растет материальное благосостояние советских людей, увеличивается и приток курортников на Южный берег Крыма. Этим и объясняется рост объема пассажирских перевозок.

In volume of passenger traffic Yalta is one of the busiest seaports of the Soviet Union. As the Soviet people's living standards rise, more and more citizens spend their holidays on the southern coast of the Crimea, with a corresponding expansion of sea passenger traffic.

Почти круглый год пассажирские суда Ялтинского порта курсируют между курортными пунктами Южного берега Крыма.

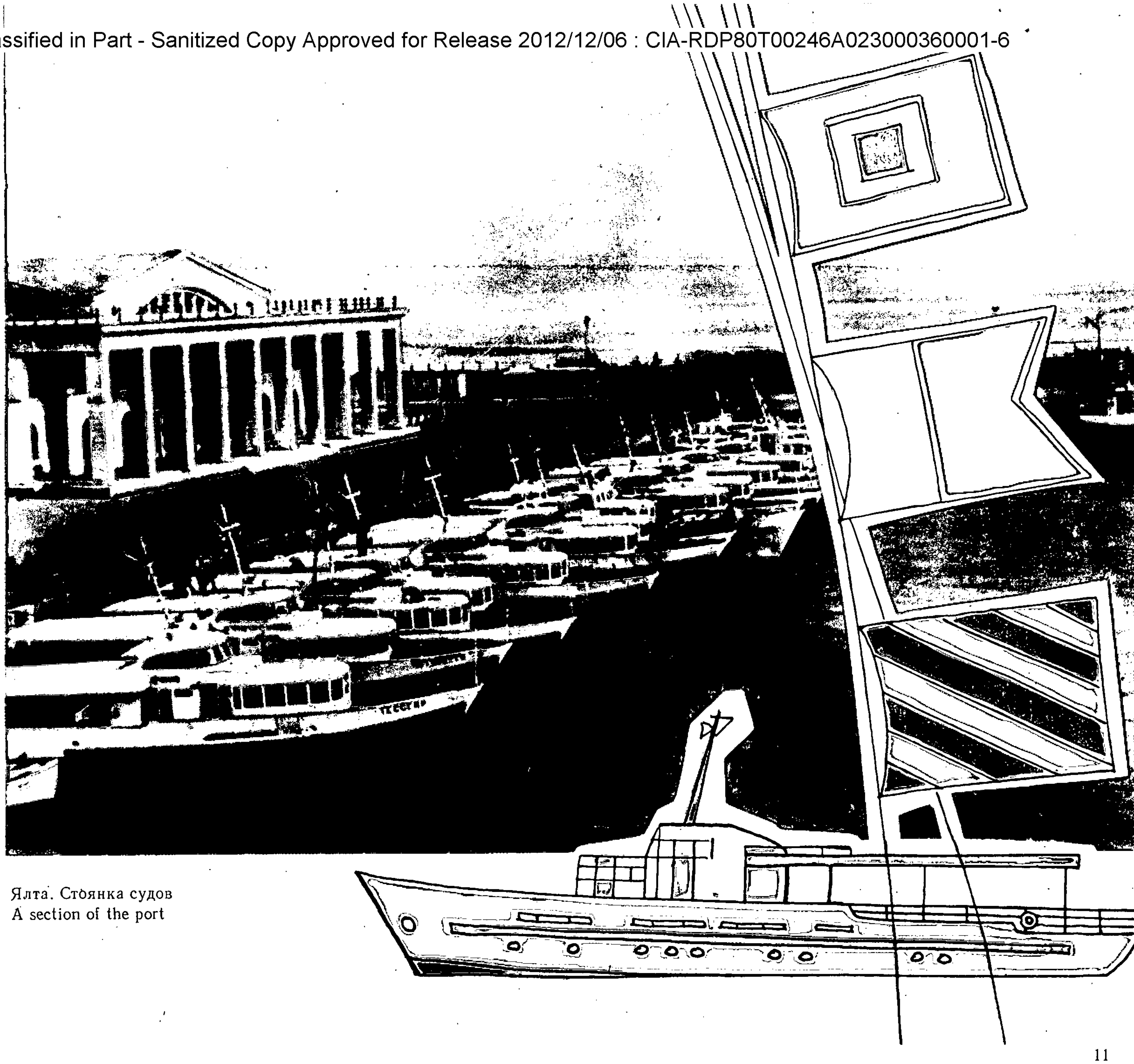
Зимой и летом на этих судах десятки тысяч отдыхающих совершают морские экскурсии по историческим и достопримечательным местам.

Семилетним планом предусмотрено дальнейшее расширение и реконструкция порта, строительство нового грузового порта и пополнение портового флота новыми быстроходными пассажирскими судами на подводных крыльях.

Yalta Port operates a regular passenger service between Yalta and the main resorts along the southern coast of the Crimea practically all the year round.

Winter and summer, excursion boats take tens of thousands of visitors to historic places and other sights in the Crimea.

The Seven-Year Plan (1959 to 1965) calls for further expansion and modernization of the port, construction of a new cargo port, and introduction of a number of fast hydrofoil boats on the local passenger lines.



Ялта. Стоянка судов
A section of the port

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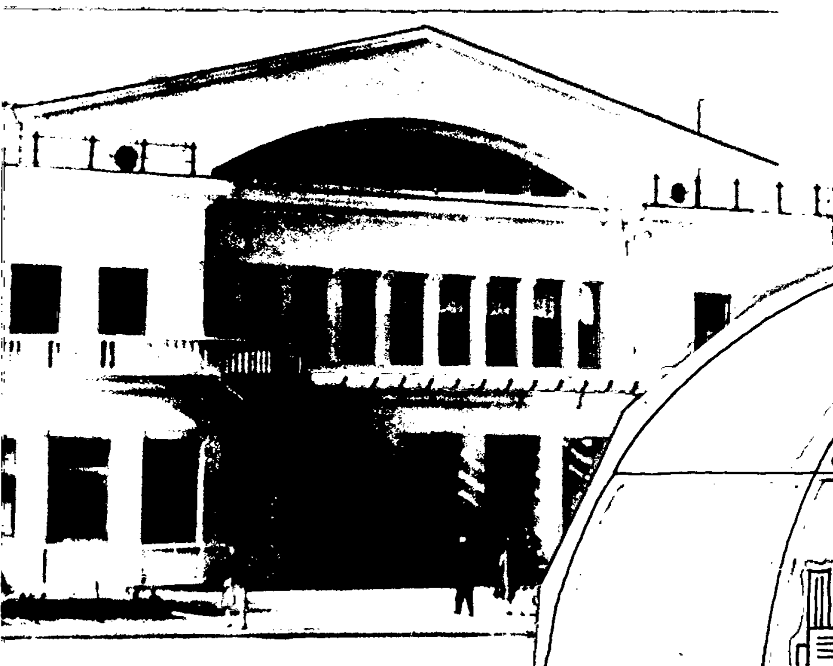
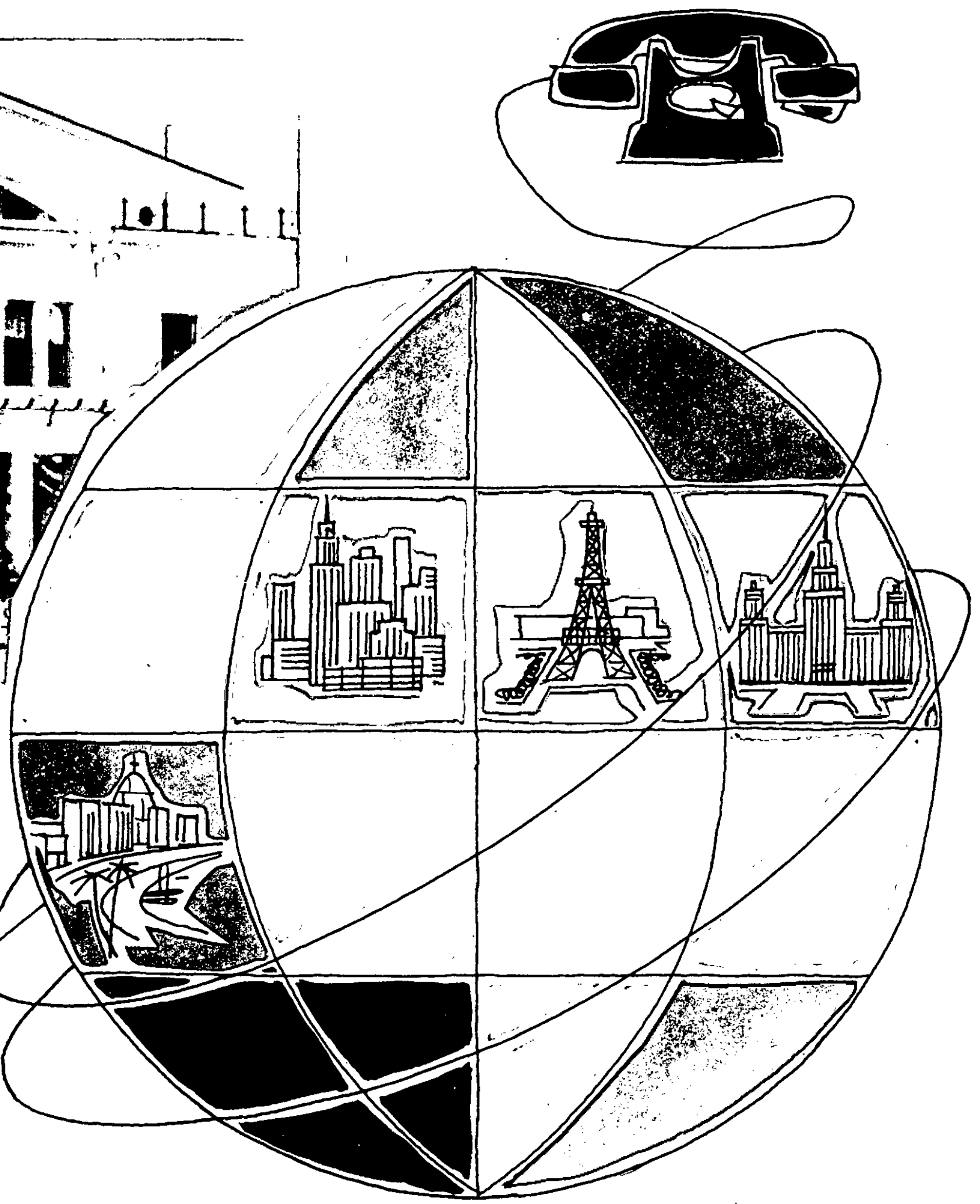


Ялта. Морской вокзал. Вид со стороны города
The marine passenger station in Yalta



Во время оккупации Ялты фашисты полностью разрушили порт. Не осталось ни причалов, ни морского вокзала, ни одного уцелевшего здания. Небольшой коллектив рабочих и инженеров много потрудился, чтобы поднять порт из руин и сделать его первоклассным.

Новый морской вокзал красив, удобен и уютен. К услугам пассажиров ресторан и парикмахерская, почта и телеграф. Отсюда можно поговорить по телефону с любым городом мира. В здании морского вокзала имеется и обменный пункт государственного банка СССР, где производится обмен иностранной валюты.

In the last war the nazi invaders completely destroyed the port of Yalta. They wrecked the marine passenger station, the piers and all the port buildings. The port workers and engineers put in a great deal of effort to raise the structures from the ruins and make Yalta a first-class port. The new passenger station is a well-appointed building with restaurant, barber shop, and post and telegraph office. You can put through a telephone call from here to any city in the world.

Foreign currency can be exchanged at an office of the State Bank of the USSR in the station building.

Внимательны и заботливы врачи и медицинские сестры амбулатории портовиков. Они следят за здоровьем матросов, мотористов катеров, портовых рабочих — всех, кому доверено почетное и благородное дело обслуживания пассажиров морских судов. Работники порта и их семьи, как и все граждане нашей страны, лечатся бесплатно. Иностранные туристы и моряки пользуются бесплатной медицинской помощью наравне с советскими гражданами.

Кроме лечебной, врачи проводят большую профилактическую работу.

В благоустроенном особняке, недалеко от моря, расположен детский сад. Хорошо и весело здесь малышам — детям работников порта. Средства на содержание детского сада выделяет государство.

The medical staff of the port out-patient clinic cerefully watch over the health of the seamen, port workers, motor-mechanics and all those who are entrusted with the honourable task of attending the passengers. Like all citizens of the Soviet Union port workers and their families get free medical care.

Foreign tourists and seamen receive free medical treatment on the same basis as Soviet citizens.

In addition to treating patients, Soviet doctors carry out extensive disease-prevention work.

The children of the port workers are having a very happy time in their kindergarten, which occupies a well-built house near the beach. This kindergarten is maintained by the state.

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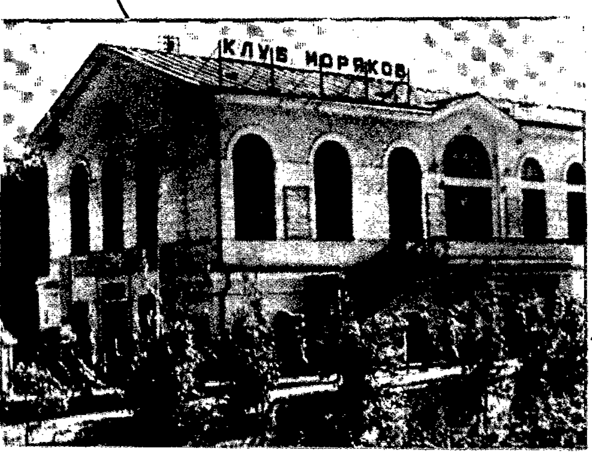
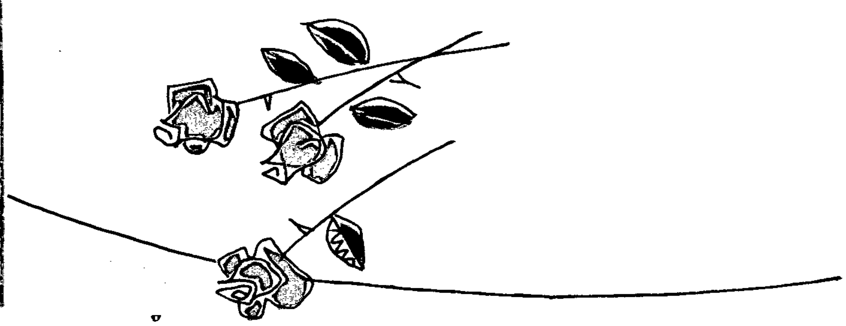
Ялта. Клуб моряков
The Seamen's Club, Yalta





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По вечерам из ярко освещенных залов клуба моряков доносятся звуки рояля. В танцевальном салоне веселится молодежь. Во вместительном кинозале демонстрируется новый фильм...

Ялтинские портовики любят свой клуб и часто приходят сюда вместе с женами и детьми. В клубе организован университет культуры, работают кружки художественной самодеятельности, духовой и струнный оркестры, кабинеты техники и фотолюбителей.

Моряки иностранных судов всегда находят в клубе радушный прием. Они — желанные гости портовиков Ялты.

In the evening you will hear music coming from the brightly-lit halls of the Seamen's Club in Yalta. The young people are dancing in the ball-room of the Club. In a spacious cinema hall you can see a new film...

The Seamen's Club is very popular among port workers who often come here with their families.

The Club boasts a University of Culture, amateur talent groups, a brass band, and a string orchestra. It has a number of technical hobby and amateur photography rooms.

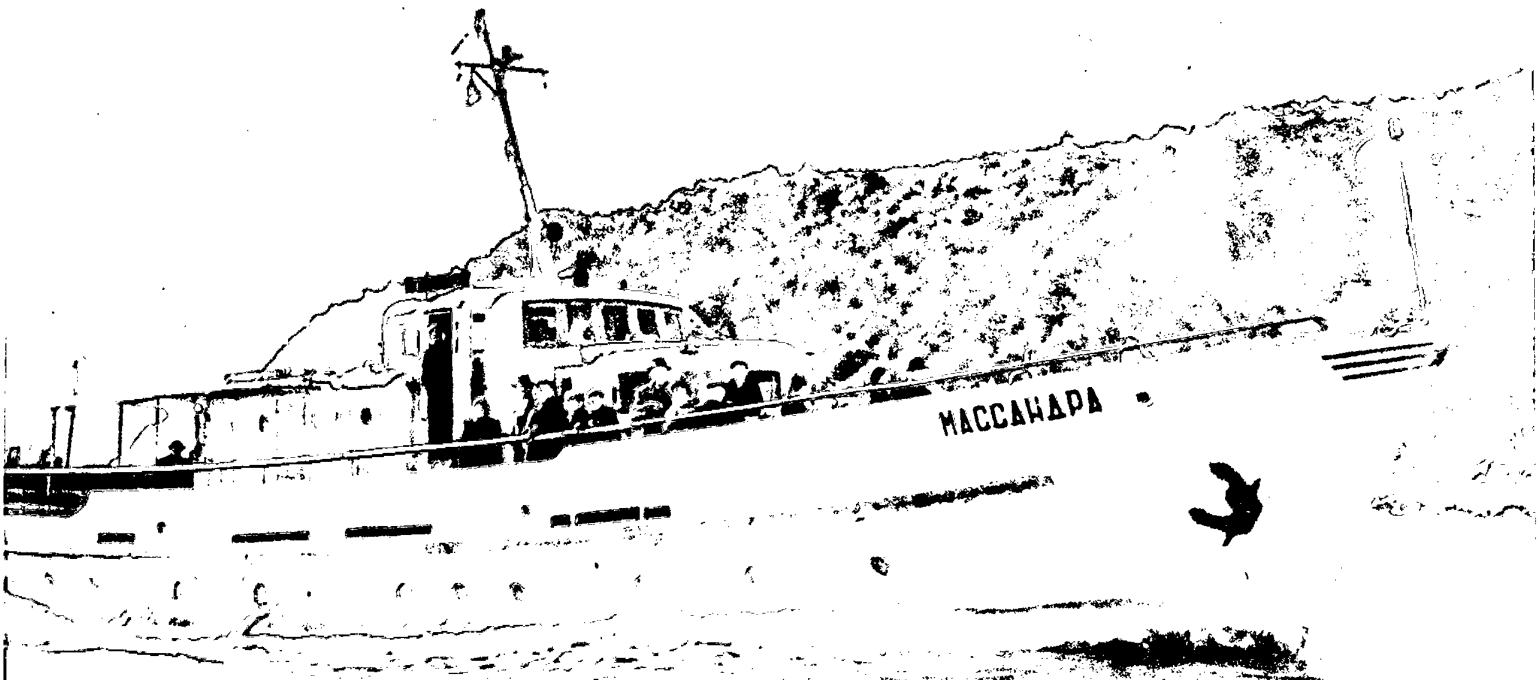
Seamen from foreign ships are always sure of a cordial welcome at the club from Yalta's port workers.

После освобождения Ялты от немецких оккупантов работники порта своими силами построили 48 морских судов типа «Ласточка». Сейчас на смену «Ласточке» пришли новые, более совершенные и комфортабельные суда заводской постройки. Каждое из таких судов может перевозить до 120 пассажиров и развивать скорость 11 миль в час. Уютные салоны, удобные кресла и диваны, тенты на палубе — все это делает пребывание на катере приятным и оставляет незабываемые впечатления от поездок вдоль Южного берега Крыма, в Севастополь, Судак, Феодосию.

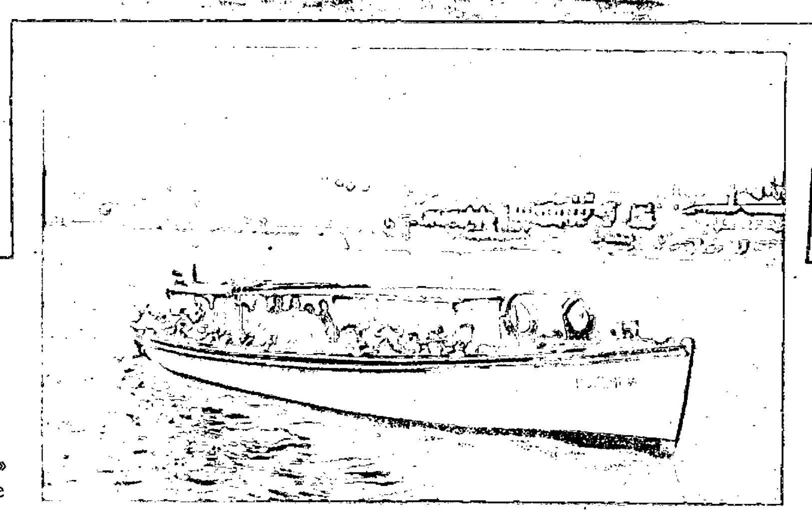
After Yalta was liberated from the nazi invaders the port workers themselves built a fleet of motor launches of the Lastochka type for the local excursion and passenger service. They have now been replaced by new, faster and more comfortable factory-made boats.

These boats carry 120 passengers, cruising eleven miles an hour. The boats have cosy salons. There are desk-chairs and tents.

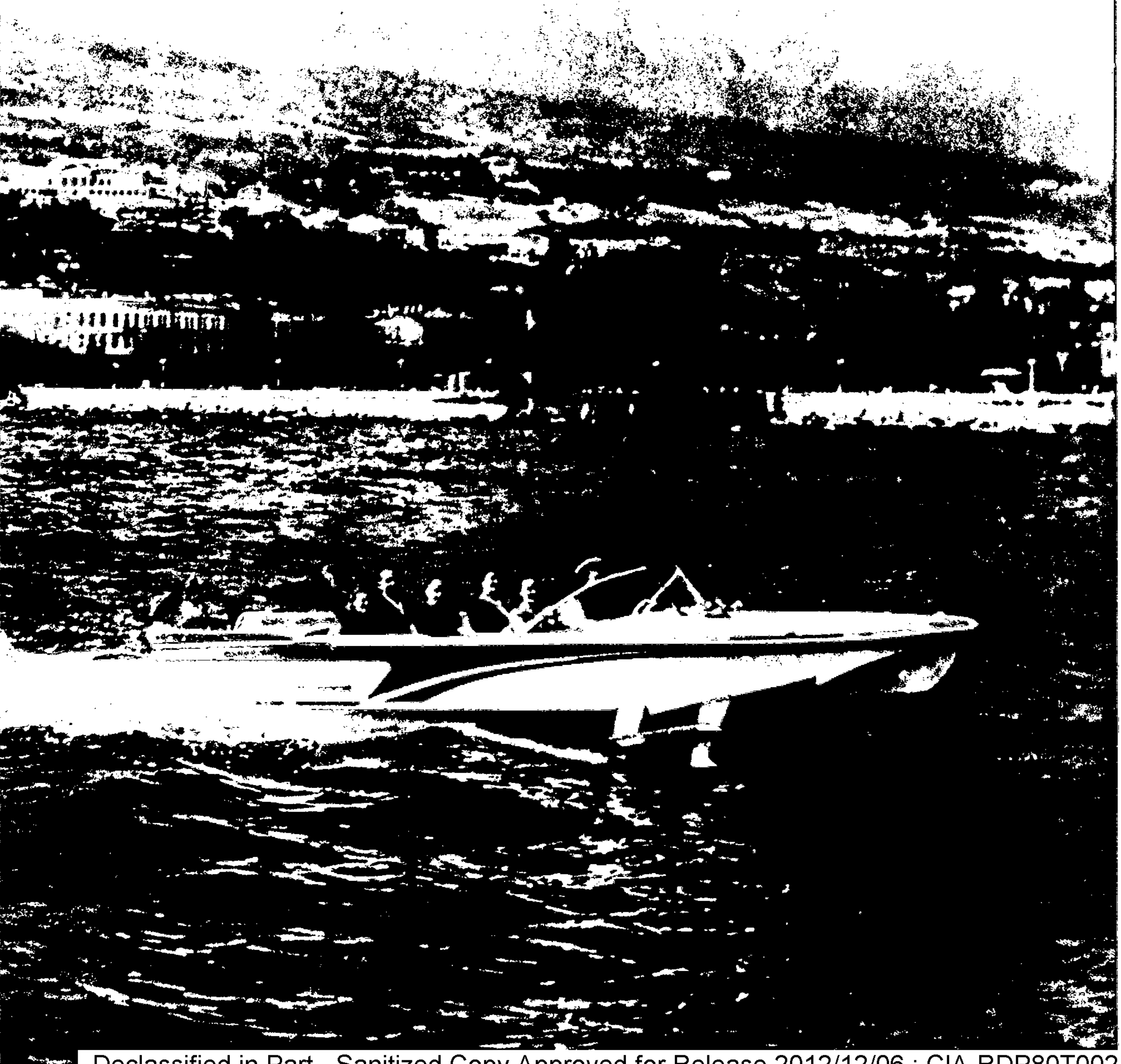
A trip along the southern coast of the Crimea, to Sevastopol, Sudak and Feodosia is a pleasant and unforgettable experience.



Теплоход «Массандра»
The m. s. Massandra



Морской катер типа «Ласточка»
A motor launch of the Lastochka type



Катер на подводных крыльях
A hydrofoil boat

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Ялта — это морские ворота Южного берега Крыма. В Ялтинском порту останавливаются пассажирские крупнотоннажные суда дальнего следования. Курортники могут посетить Ливадию, Золотой пляж, «Ласточкино гнездо», Мисхор, Алупку, Симеиз, Кастрополь, Форос, Гурзуф, Фрунзенское, Алушту, Судак.

Yalta is the sea gate of the Crimea's southern coast. Large passenger ships call at the port. From here, holiday-makers can take trips along the coast to Livadia, Gold Beach, "Swallow's Nest", Miskhor, Alupka, Simeiz, Kastropol, Foros, Gurzuf, Frunzenskoye, Alushta and Sudak.

Boats ply between Yalta and the resorts along the coast.

В Ливадии — бывшей резиденции русских царей — отдыхают трудящиеся со всех концов СССР. Здесь прекрасный пляж, который привлекает не только курортников санатория «Ливадия», но и многих туристов. Они приезжают сюда на катерах, отходящих из Ялты в Ливадию через каждые 10 минут.

Приятная прогулка на катере от Ялты до Золотого пляжа — одного из лучших на Южном берегу Крыма — занимает 20 минут.

Десятки тысяч курортников Ялты, Алупки и других мест для поездки на Золотой пляж пользуются услугами Ялтинского порта. В кассах порта продаются абонементы на морские катера.

Livadia, formerly a palace of the Russian tsars, is now a health centre for Soviet working people from all parts of the USSR. There is a magnificent beach which attracts not only holiday-makers but many tourists as well. They come here by motor launch, which leaves Yalta for Livadia every ten minutes.

You may make a fascinating 20-minute trip by motor launch from Yalta to Gold Beach, one of the best bathing places along the southern coast of the Crimea.

Tens of thousands of holidaymakers in Yalta, Alupka and other resorts travel to Gold Beach in boats of the local line. Tickets valid for a month can be bought in the Yalta port.

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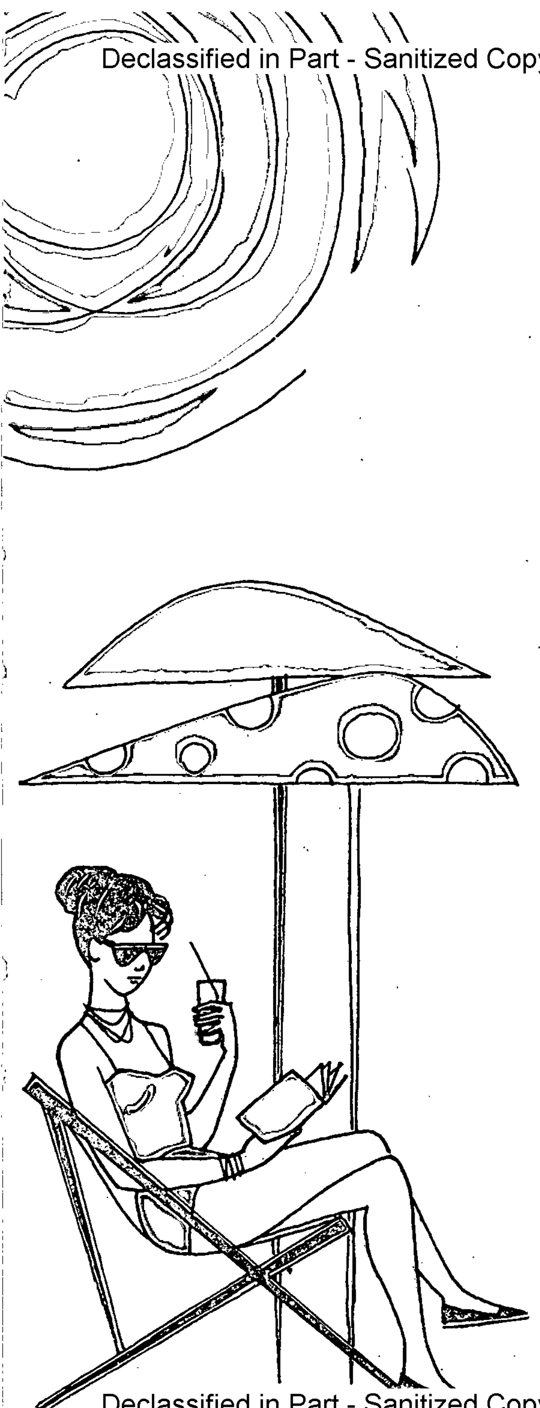
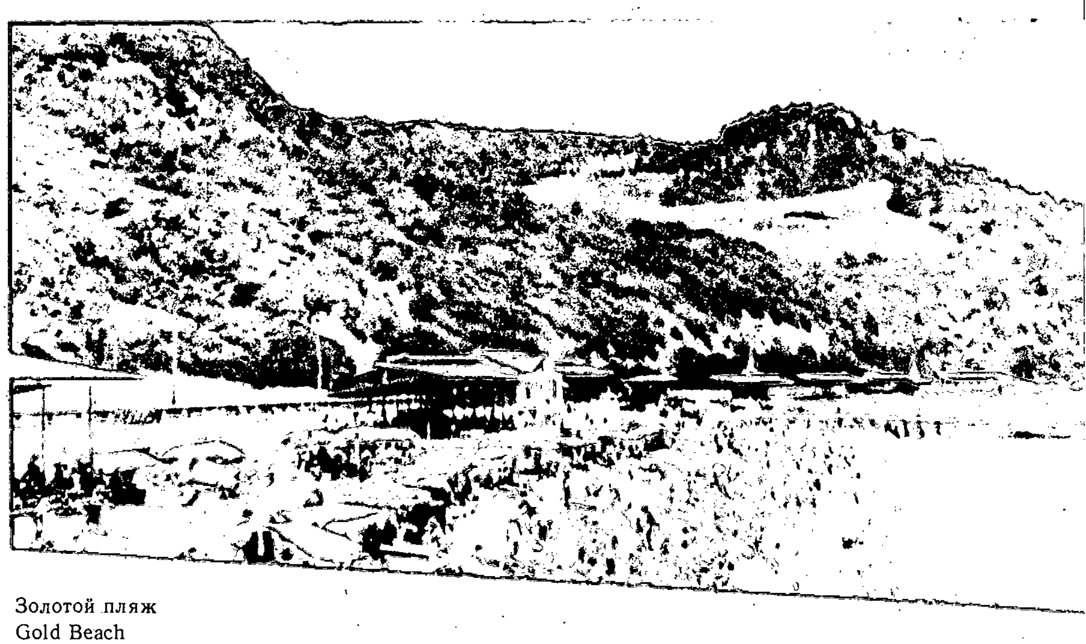


Южный берег Крыма
A view of the southern coast of the Crimea



Золотой пляж
Gold Beach

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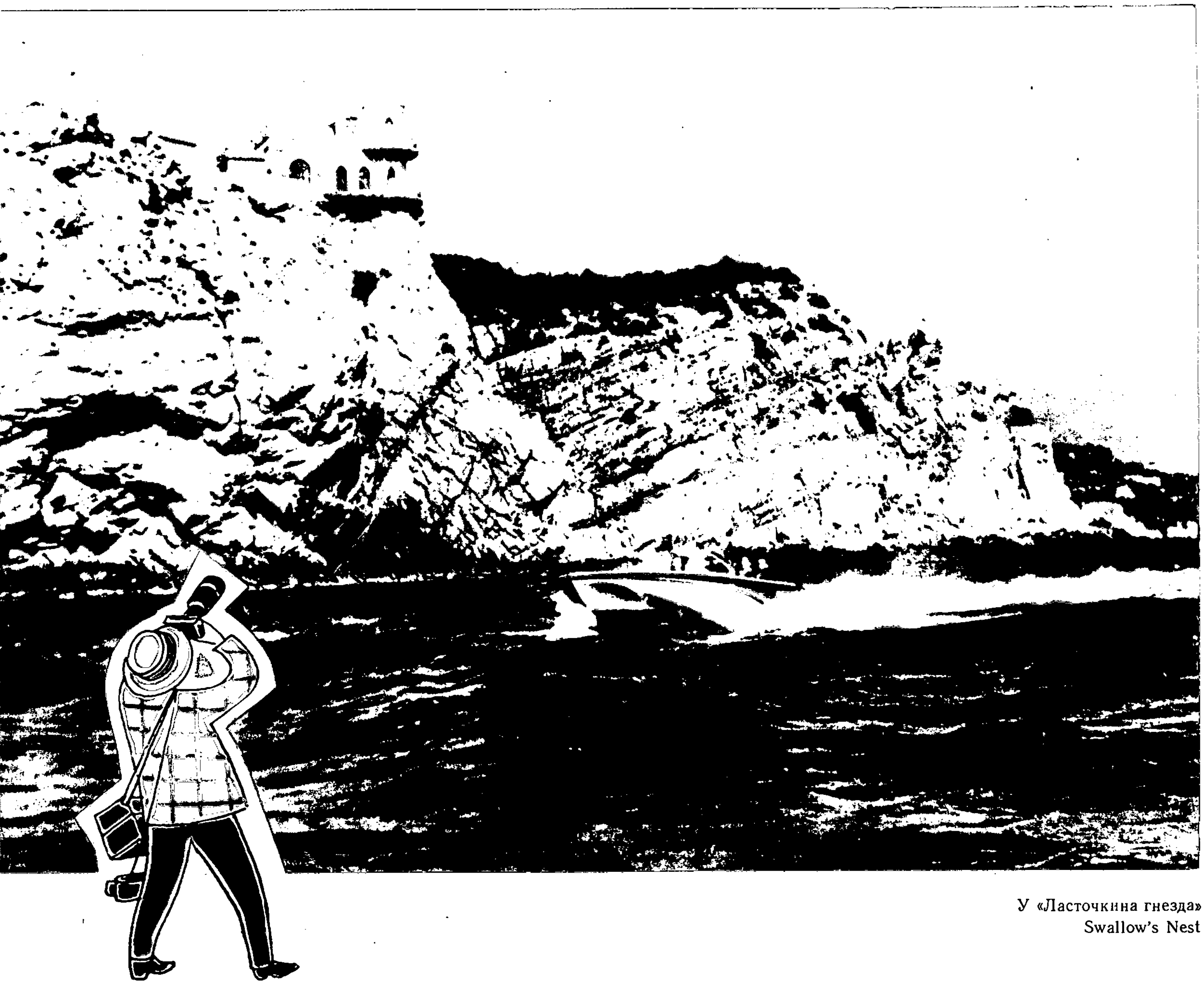

У «Ласточкина гнезда»
Swallow's Nest

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Неподалеку от Золотого пляжа глубоко в море вдается мыс Ай-Тодор — огромная и крутая скала. На одном из отрогов, нависшим над морем, возвышается здание, напоминающее средневековый рыцарский замок. Это — «Ласточкино гнездо», которое стремится посмотреть каждый, кто приезжает в Крым.

A sight the visitor to the Crimea should not miss is "Swallow's Nest", a villa in the style of a medieval castle clinging precariously to the edge of a great Ai-Todor crag not far from Gold Beach that juts out deep into the sea.

Мисхор — один из живописных курортов Крыма. Мисхорский парк по праву считается лучшим на побережье. Здесь расположены первоклассные здравницы. Построен крупный санаторий «Украина» с искусственным морским бассейном, где можно купаться в любое время года.

В Мисхорском парке — ресторан, столовая; у причала оборудован павильон с легкими закусками и прохладительными напитками.

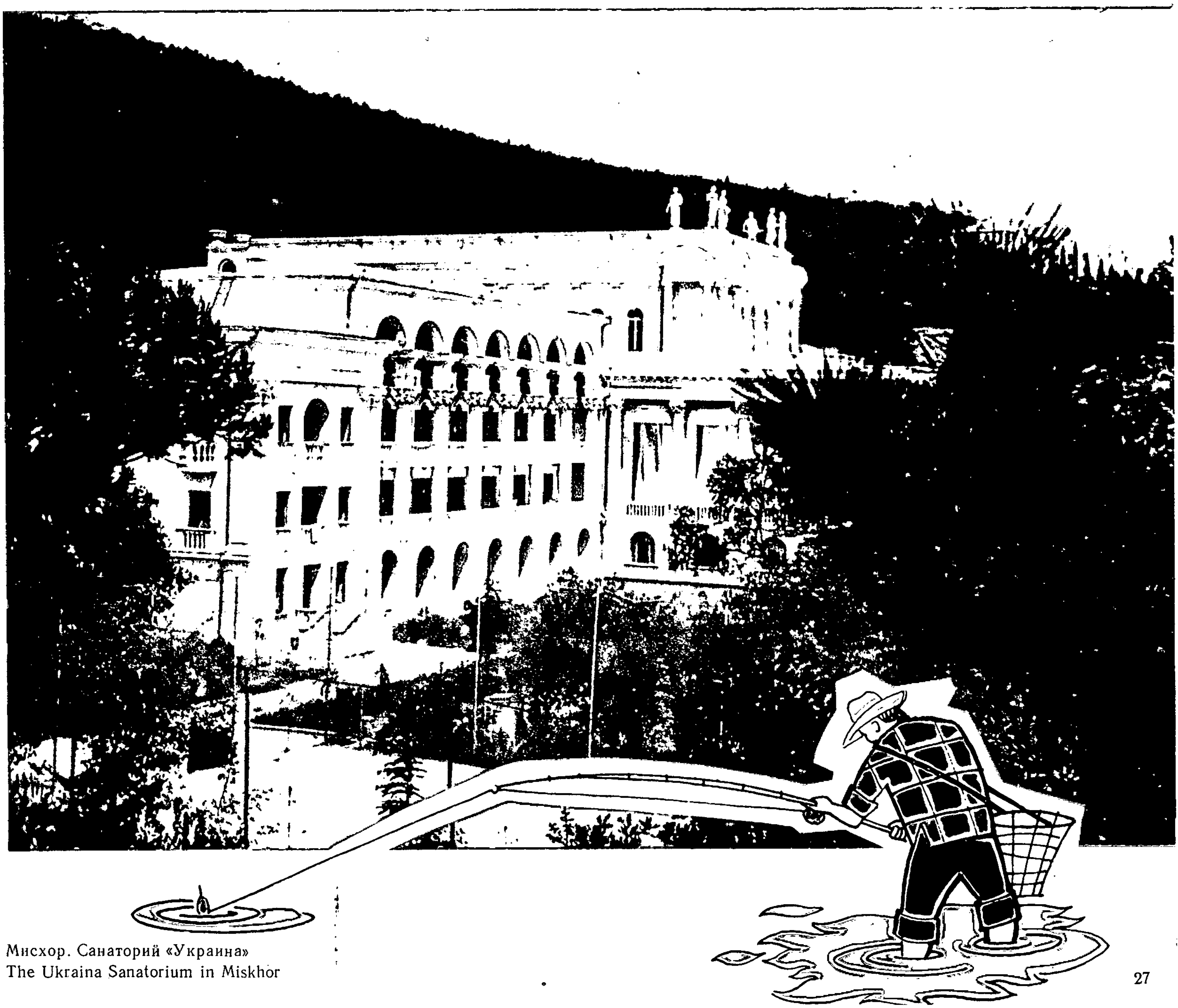
Суда Ялтинского порта, курсирующие между Ялтой и Алупкой, заходят в Мисхор. Продолжительность пути от Ялты до Мисхора — 40 минут.

Mishkhor is one of the loveliest spots in the Crimea. A number of first-class holiday homes and health centres are situated here, including the large Ukraina Sanatorium, which has an indoor sea-water swimming pool.

The Miskhor park is deservedly considered the best along the Crimean coast.

Boats of the Yalta—Alupka line stop at Miskhor. The trip by sea from Yalta to Miskhor takes 40 minutes.

There is a restaurant in the beautiful park at Miskhor and a snack bar near the pier.



Мисхор. Санаторий «Украина»
The Ukraina Sanatorium in Miskhor

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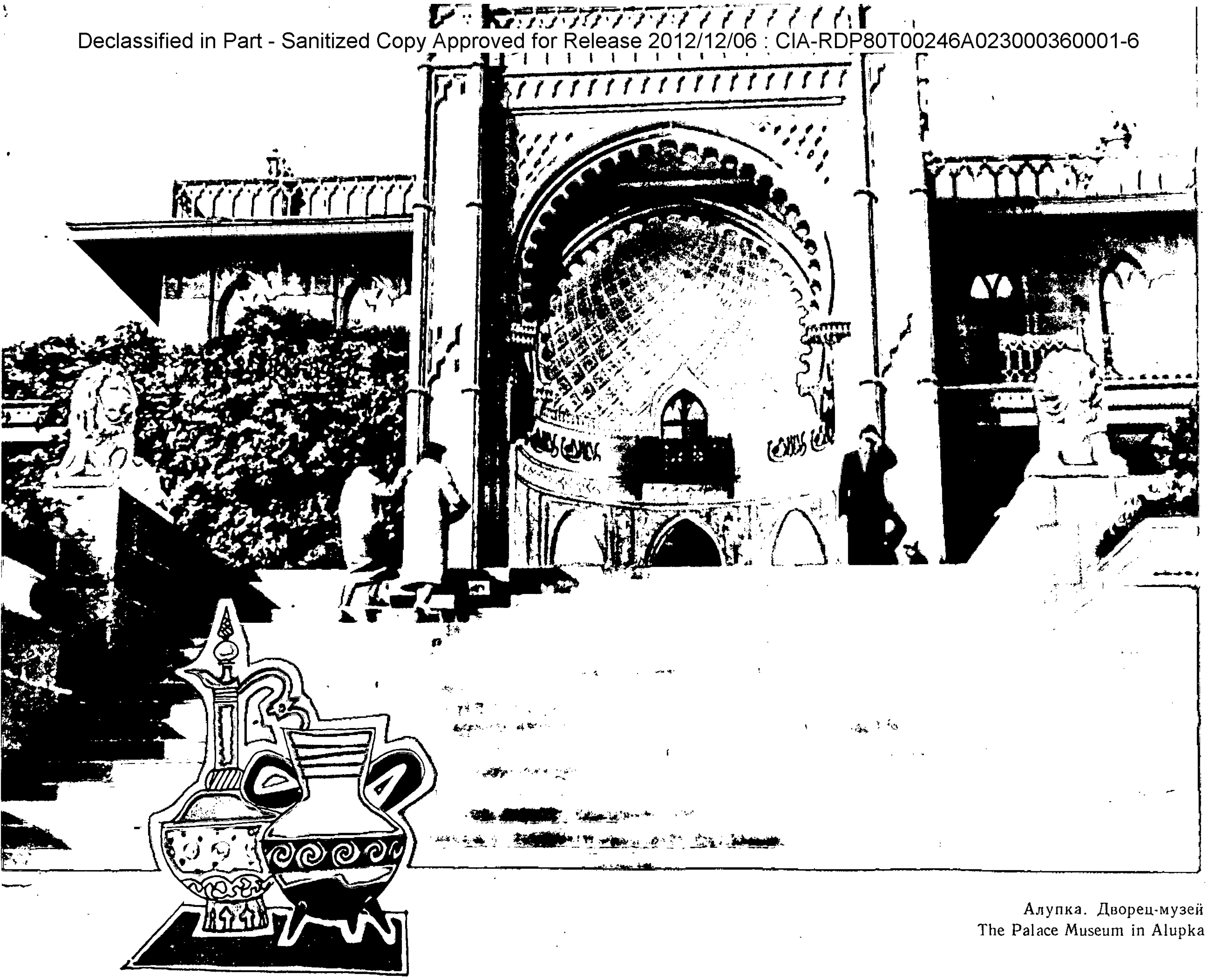

Алупка. Дворец-музей
The Palace Museum in Alupka

Алупка — второй по значению после Ялты курорт на Южном берегу Крыма.

Внимание многочисленных посетителей привлекает Алупкинский дворец, построенный в начале прошлого века. Особенно красив южный фасад в мавританском стиле и широкая каменная лестница с тремя парами белых мраморных львов. Дворец окружает большой парк.

В залах дворца-музея собрано много произведений изобразительного искусства.

Удобнее всего попасть в Алупку морем. Продолжительность пути от Ялты до Алупки — 1 час.

Alupka ranks second in importance after Yalta among the resorts along the southern coast of the Crimea.

One of the main sights here is the Alupka Palace built in the beginning of the 19th century.

Especially beautiful are the southern facade of the building in the Moresque style and the "Lion Terrace", an imposing wide staircase decorated with three pairs of white marble lions. The palace stands in a large and beautiful park.

A Museum of Fine Arts has been set up in the palace.

The most convenient way to reach Alupka from Yalta is by sea. The trip takes one hour.

Один из крупнейших и наиболее старых курортов — Симеиз. Благодатный климат, обилие растительности и удобные пляжи привлекают сюда ежегодно тысячи людей. В курортном поселке Симеиз расположено семь санаториев.

Недалеко от причала в море вдается высокая скала Диво. По узкой огражденной каменной лестнице можно подняться к ее вершине; отсюда открывается бесконечная морская даль.

Симеизский пляж — один из лучших на южном берегу.

Между Ялтой и Симеизом регулярно курсируют пассажирские катера.

Simeiz is one of the oldest and largest resorts along the southern coast of the Crimea. Its salubrious climate, rich vegetation and excellent beach attract thousands of visitors every year. There are seven sanatoriums in Simeiz.

There is a beautiful cliff named "Divo" ("Wonder Tower") above the shore not far from the pier. Excursionists who climb to the top along the narrow stairway cut out of the rock are rewarded by a breath-taking view of the sea and the coast.

The beach at Simeiz is one of the finest along the southern coast.

There is a regular boat service from Yalta to Simeiz.

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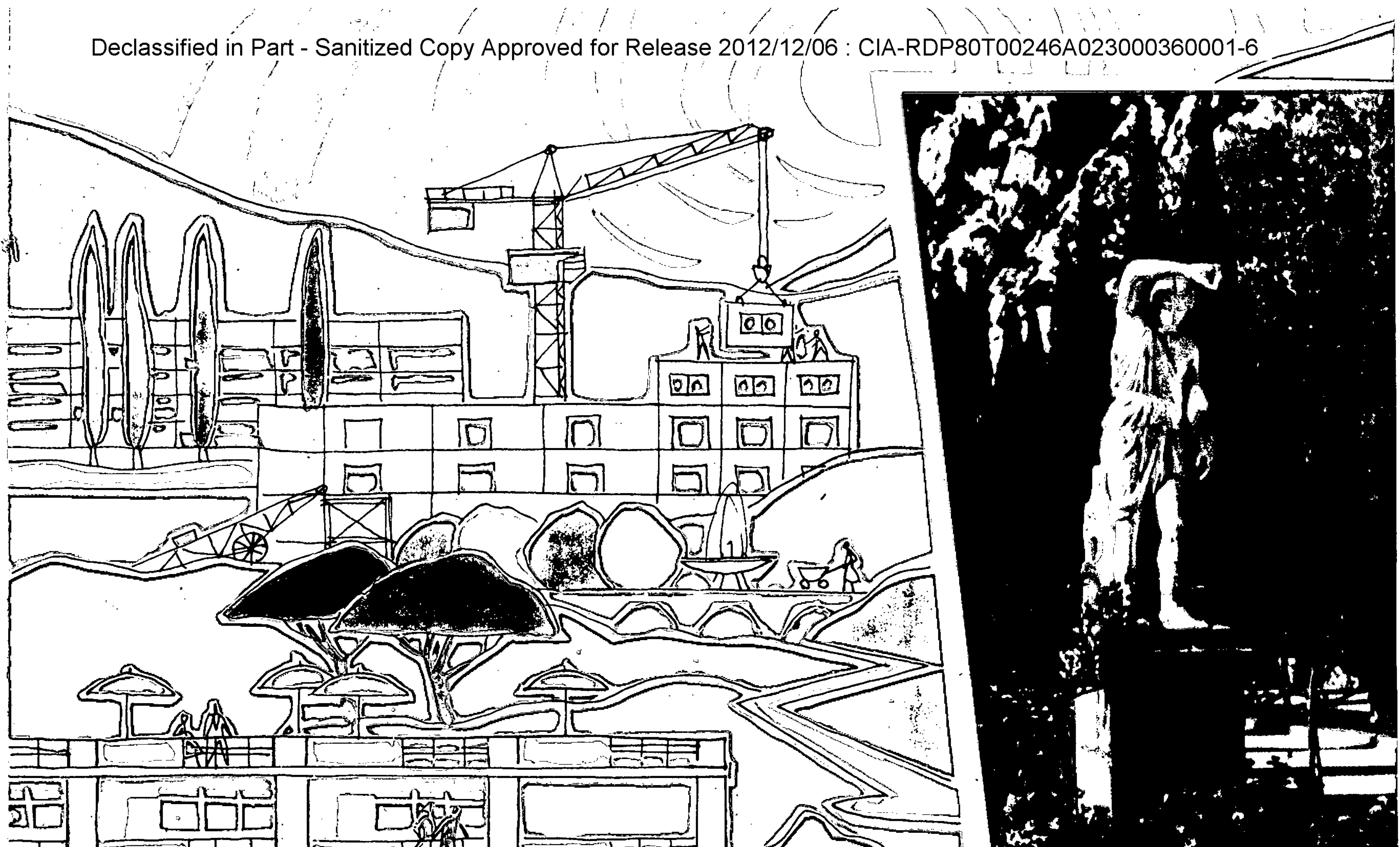
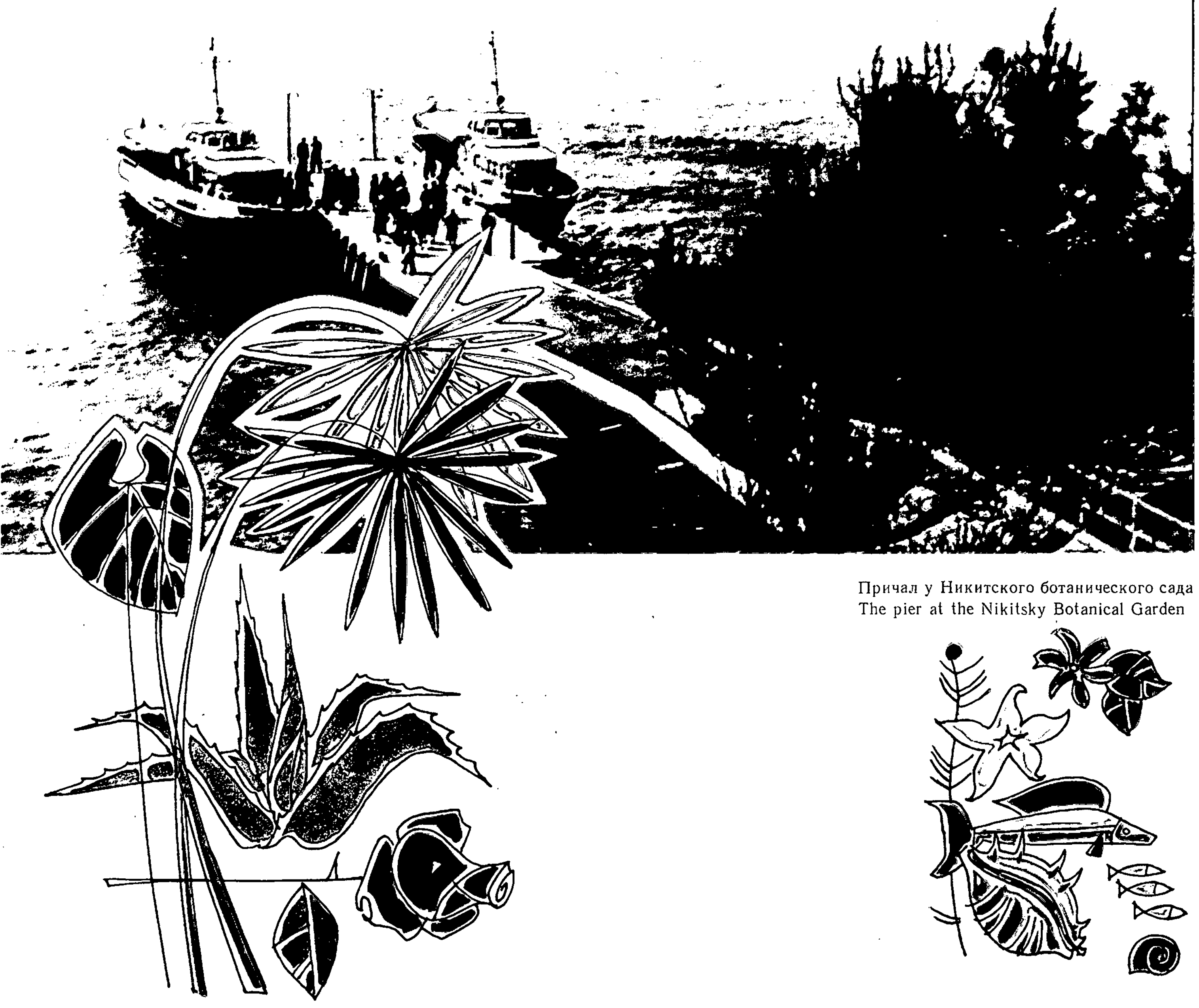


В Симеизе
A scene in Simeiz



Причал у Никитского ботанического сада
The pier at the Nikitsky Botanical Garden

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В семи километрах от Ялты раскинулась «зеленая сокровищница» Крыма — Никитский ботанический сад площадью 280 гектаров. Около 7000 видов растений собрано здесь в живую коллекцию со всех частей света.

Научные сотрудники ботанического сада на основе мичуринских методов выводят новые ценные сорта плодовых, технических и декоративных растений, помогают колхозам и совхозам выращивать богатые урожаи фруктов.

Никитский ботанический сад — первый пункт, куда заходят суда, курсирующие между Ялтой, Гурзуфом и Алуштой.

Продолжительность пути от Ялты — 15 минут.

The famous Nikitsky Botanical Garden, "green treasury of the Crimea," is only about four miles from Yalta. Covering an area of 700 acres, it contains some 7,000 species and varieties of plants from all over the world.

The staff carries out a large programme of research and, besides, gives practical assistance and advice to collective farms and state farms.

The Nikitsky Botanical Garden is the first stop on the boat lines from Yalta to Gurzuf and Yalta to Alushta.

The trip from Yalta to the Garden takes 15 minutes.

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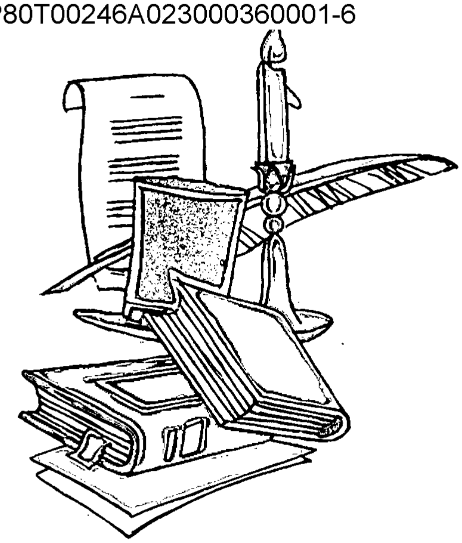
За Никитским ботаническим садом тянутся берега вечнозеленого Гурзуфа — одного из популярнейших климатических курортов Крыма. Здесь в 1820 году в доме генерала Раевского жил Александр Сергеевич Пушкин. Трехнедельное пребывание в Гурзуфе Пушкин считал счастливейшим временем своей жизни.

В богатейшем парке Гурзуфа можно увидеть новые посадки самшита, декоративного граната, туи и различных плодовых деревьев. Газоны парка украшают розы, гладиолусы, виолы, цинии.

Soon after your boat leaves the Nikitsky Botanical Garden the evergreen shores of Gurzuf, one of the Crimea's most popular climatic resorts, come into view. Alexander Pushkin the great Russian poet, spent three weeks in Gurzuf in 1820 as a guest of General Rayevsky. Pushkin regarded those three weeks as the happiest time of his life.

One of the many places in Gurzuf associated with Pushkin is a huge cliff to which the poet often came.

In the luxuriant park there are young groves of box-trees, decorative pomegrantes, thujas, fruit trees of various kinds, and colourful beds of roses, gladioli, and zinnias.



Гурзуф. Фонтан «Ночь»
The Night Fountain in Gurzuf

Общий вид Гурзуфа
A general view of Gurzuf

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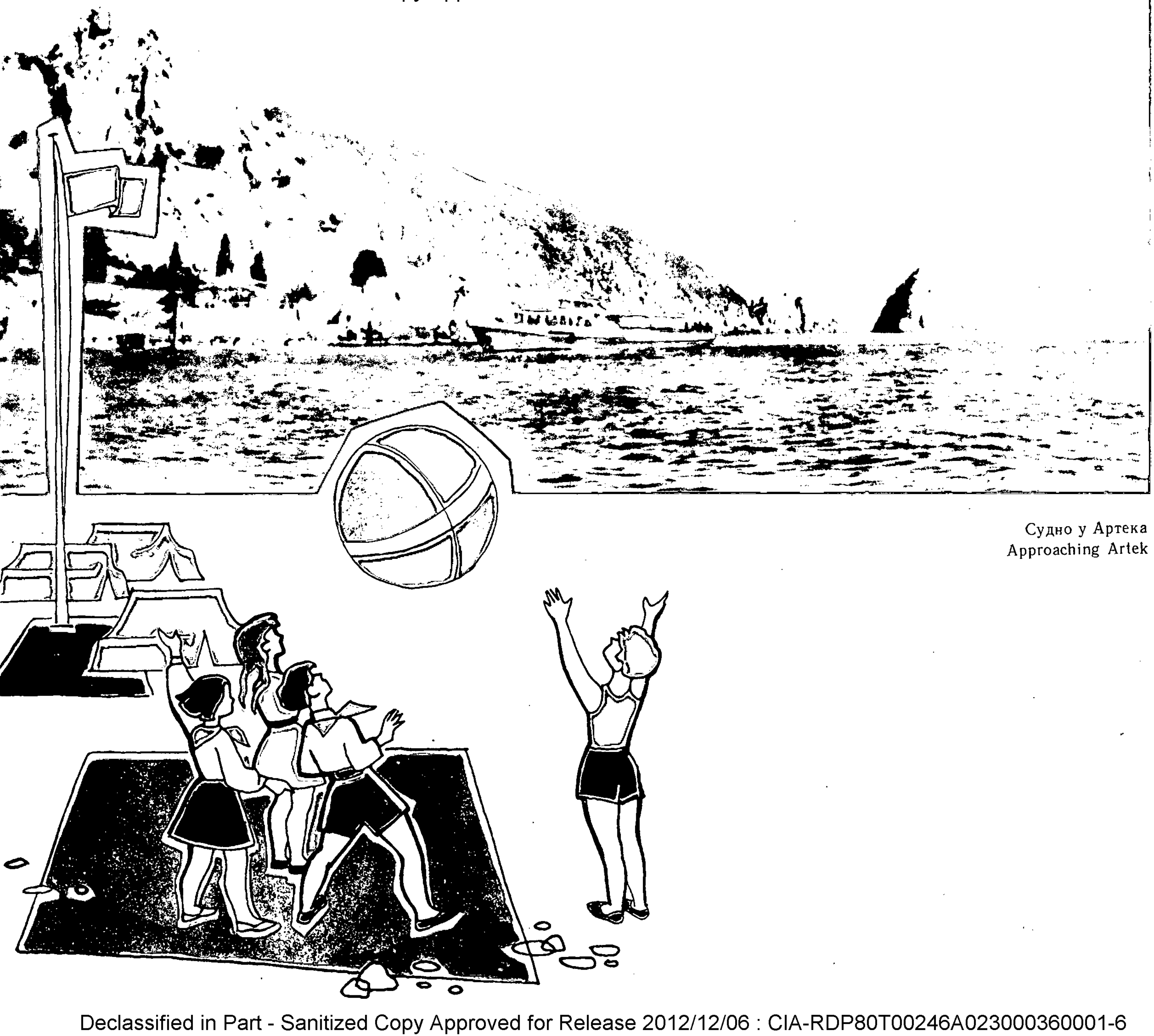

Судно у Артека
Approaching Artek

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К востоку от Гурзуфа, вдоль берега моря, у подножья горы Аю-Даг (Медведь-гора) среди кипарисов белеют корпуса всемирно известного детского санаторного лагеря «Артек».

Артек стал лагерем пионерской дружбы. Сюда приезжают дети многих зарубежных стран. Жизнь пионеров многообразна и интересна. Побывавший в гостях у артековцев французский писатель Анри Барбюс писал: «Артек — это настоящий рай, но рай земной, реальный».

У пионеров есть свой флот — быстроходные катера и мотоботы, шлюпки, ялики, байдарки.

Farther east along the coast from Gurzuf you see the white buildings of the world-famous Artek children's camp among the evergreen cypresses at the foot of Ayu-Dag (Bear Hill).

Now that boys and girls from many other countries spend their holidays at Artek, the camp has become a centre of international friendship among children. The camp offers a full and interesting programme of activities. After visiting Artek Henri Barbusse, the French author, wrote: "Artek is a true paradise—and it is a paradise on earth, a real one."

The children at Artek have their own fleet of fast motor launches, sailboats, rowboats and kayaks.

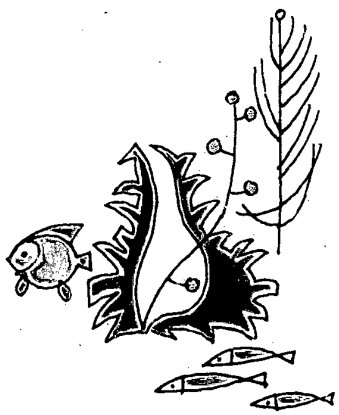
Алушта — крупный климатический курорт — расположена между Ялтой и Симферополем.

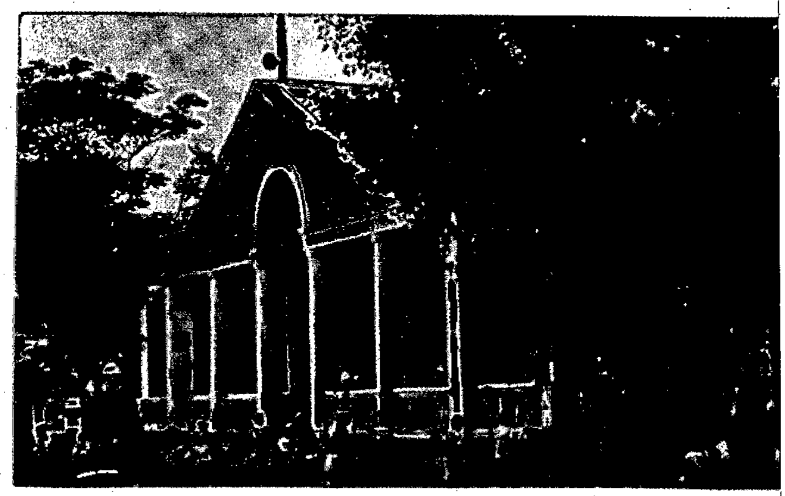
Склоны гор, окружающих Алушту, усажены виноградной лозой, цитрусовыми культурами, табаком. Вся Алушта утопает в фруктовых садах.

Комфортабельные пассажирские теплоходы Ялтинского морского порта отходят из Ялты и Алушты по расписанию. Время работы теплоходов составлено с учетом прибытия и отправления пассажирских поездов в Симферополь. Приезжающие на Южный берег Крыма и уезжающие курортники могут широко пользоваться морским транспортом.

Alushta, a large climatic resort on the coast, is situated about half way between Yalta and Simferopol, administrative centre of the Crimea. The port of Yalta operates a line of comfortable passenger boats between Yalta and Alushta. The schedule of arrivals and departures is coordinated with the Simferopol train timetable. Holiday-makers arriving on the southern coast of the Crimea from Simferopol or leaving for home find the boat line a great convenience.

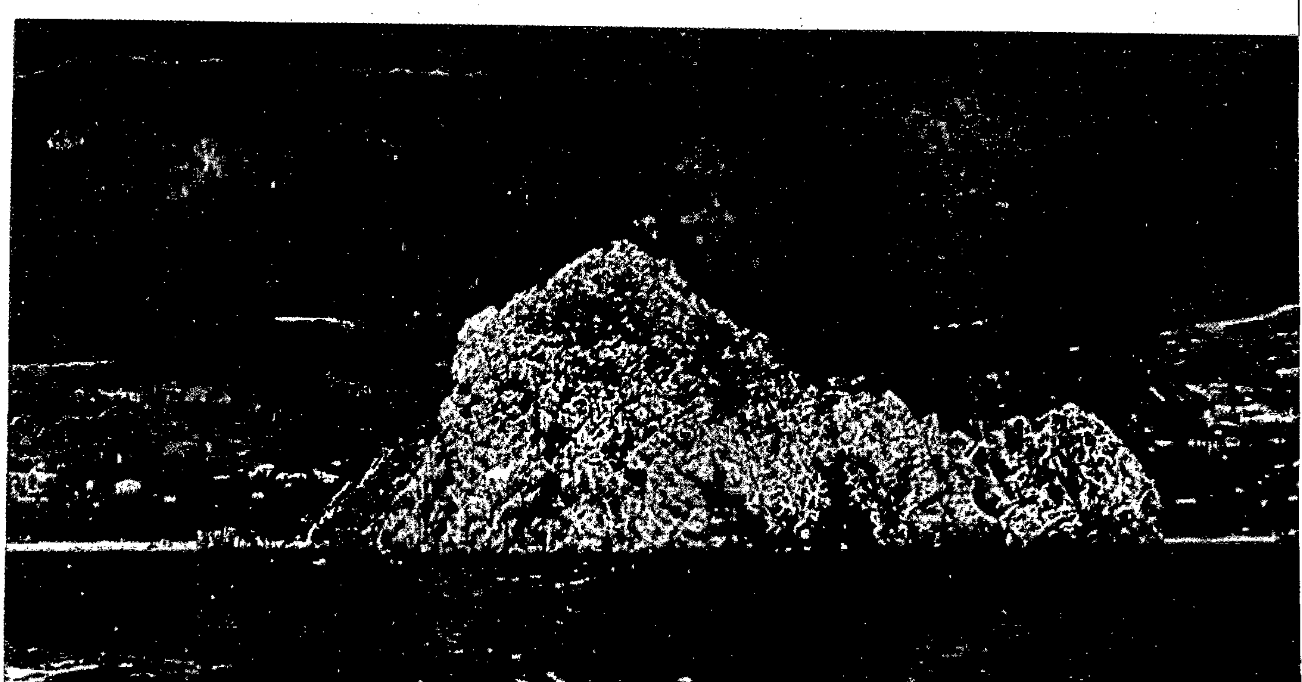
The slopes of the mountains which enclose Alushta are covered with vineyards, citric trees and tobacco plantations. Alushta is buried in flowering orchards.





Южный берег Крыма
The southern coast of the Crimea

Алушта. Портпункт
The port administration building in Alushta



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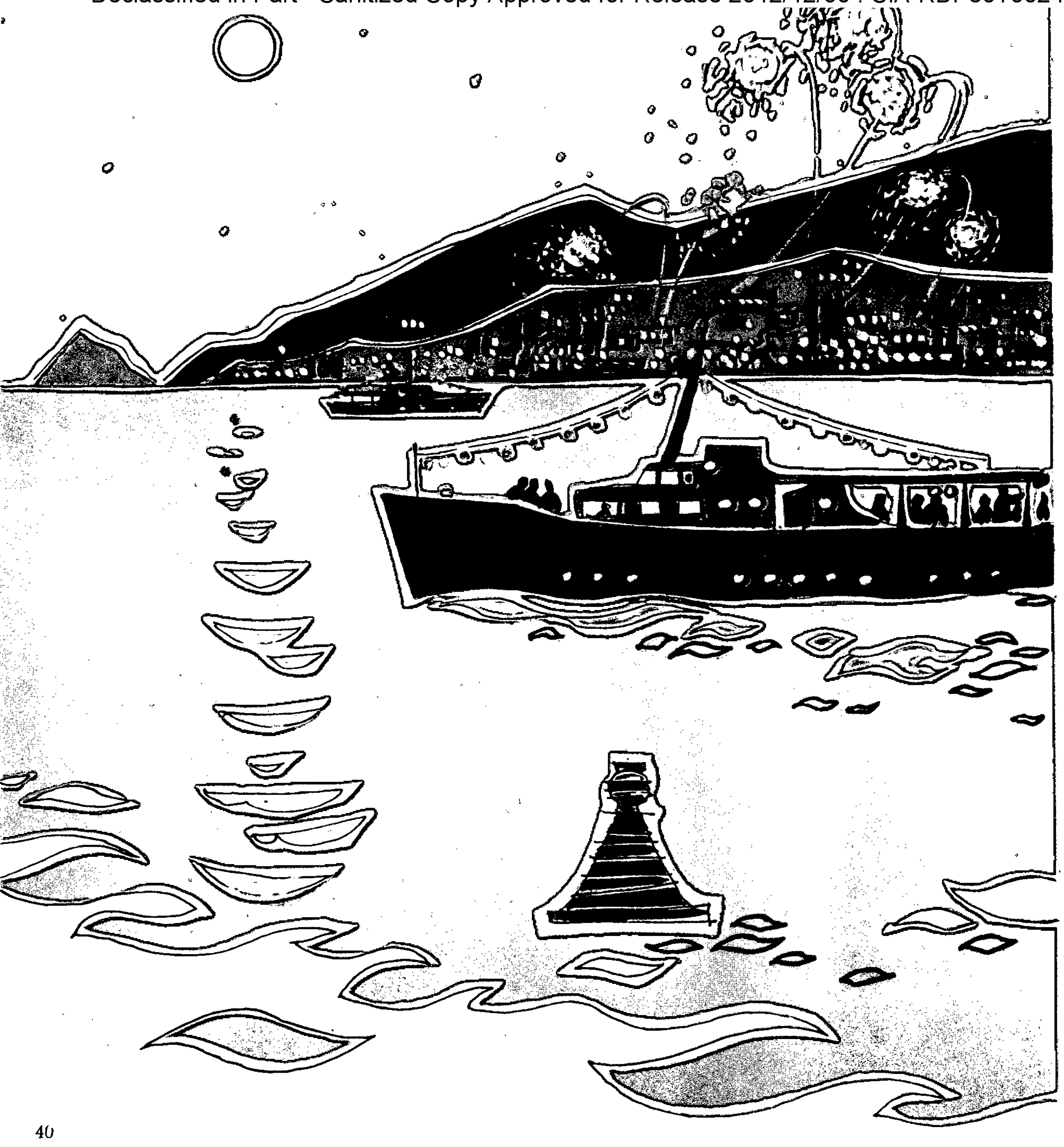

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Что может быть приятнее вечерней прогулки по морю под звуки музыки!

...Южная теплая ночь. Бесшумно скользит теплоход по неподвижной глади моря. Как в зеркале отражаются ярко освещенные иллюминаторы, рулевая рубка — весь четкий силуэт катера.

Ежедневно с наступлением сумерек множество курортников, туристов и жителей Ялты совершают вечерние прогулки на судах Ялтинского порта, иллюминированных тысячами огней.

What could be nicer than an evening cruise along the coast to the strains of music. There is no finer pastime in the summer months, than such evening excursions.

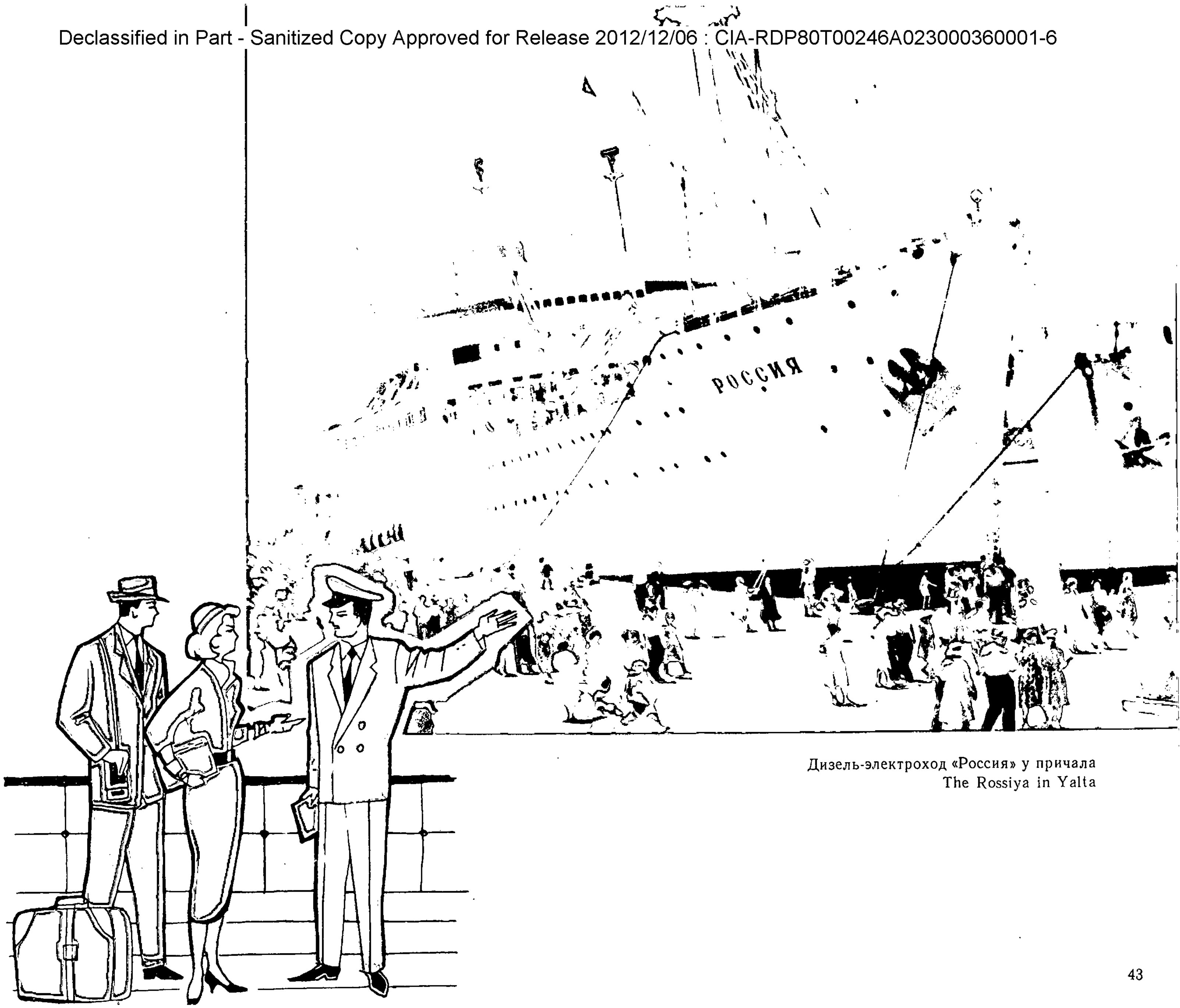
It is a warm southern evening. Our boat noiselessly glides over the mirror-like sea. The silhouette of the brightly lit boat is clearly reflected in the water. Every day at twilight holiday-makers, tourists and Yalta residents board brightly illuminated excursion boats in the port of Yalta.

В Ялтинский порт заходят комфортабельные пассажирские суда экспрессной линии Одесса—Батуми.

Ежегодно более 100 тысяч пассажиров совершают морские путешествия в порты Черного и Азовского морей.

Large well-appointed ships of the Odessa—Batumi passenger express line call at Yalta.

More than 100,000 passengers travel annually from Yalta to other ports on the Black and Azov seas.



Дизель-электроход «Россия» у причала
The Rossiya in Yalta

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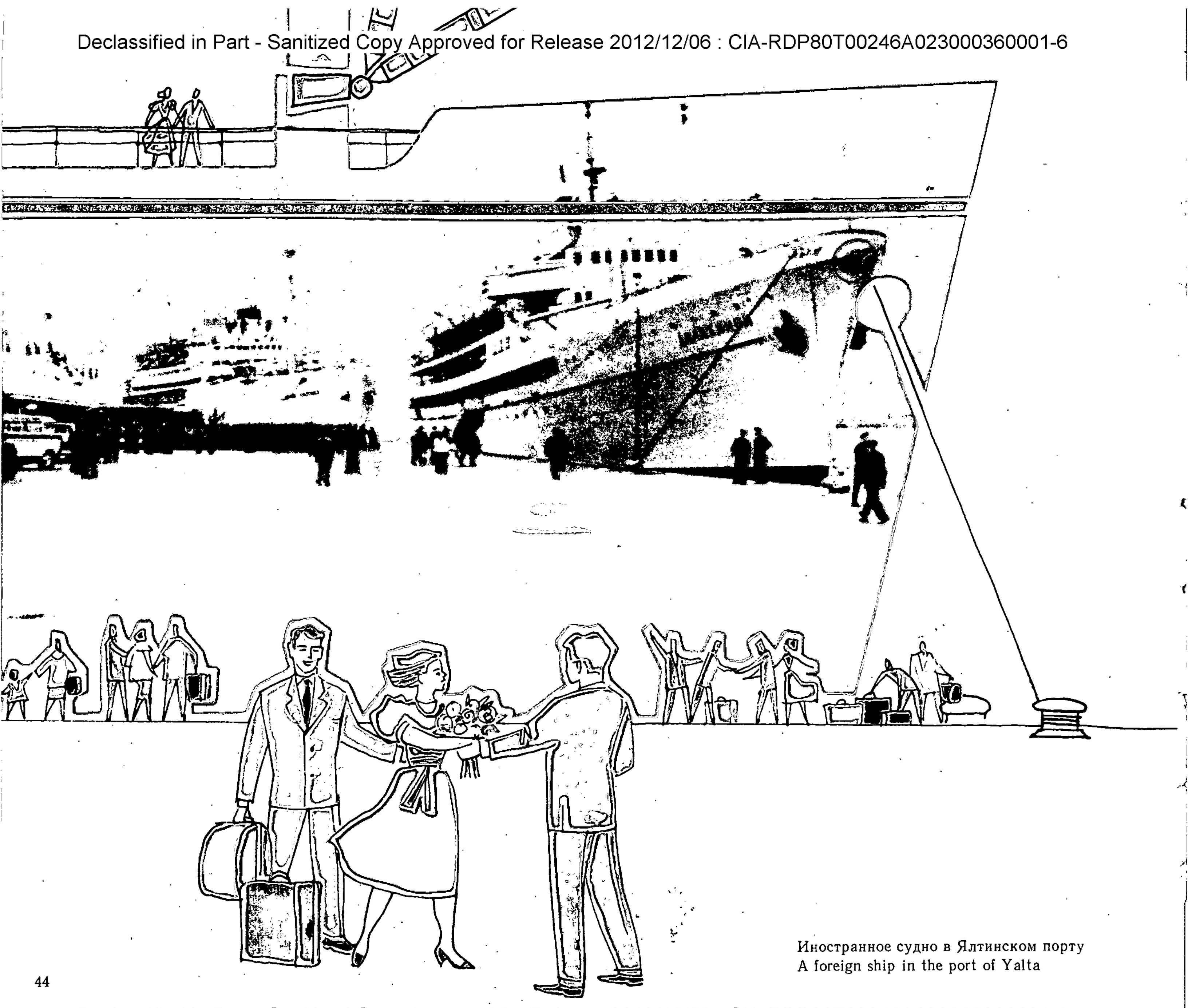


Иностранное судно в Ялтинском порту
A foreign ship in the port of Yalta

Почти каждый иностранный турист, прибывающий в СССР, посещает Ялту. Только в 1960 году в Ялте побывало около 18 000 туристов. Англичане и греки, французы и румыны, шведы и болгары, американцы и чехи — все найдут у нас радушие, внимание и дружеское гостеприимство.

Отделение «Интурист» организует экскурсионные поездки туристов, выделяет переводчиков и экскурсоводов.

Almost every foreign tourist visiting the USSR comes to Yalta. About 18,000 foreign tourists from Britain, Greece, France, Rumania, Sweden, Bulgaria, the United States, Czechoslovakia and other countries visited Yalta in 1960. They all receive a most cordial welcome here.

The local branch of the Intourist agency arranges excursions for tourists and supplies interpreters and guides.

К глубоководным причалам Ялтинского морского порта могут швартоваться океанские пассажирские и крупнотоннажные грузовые суда.

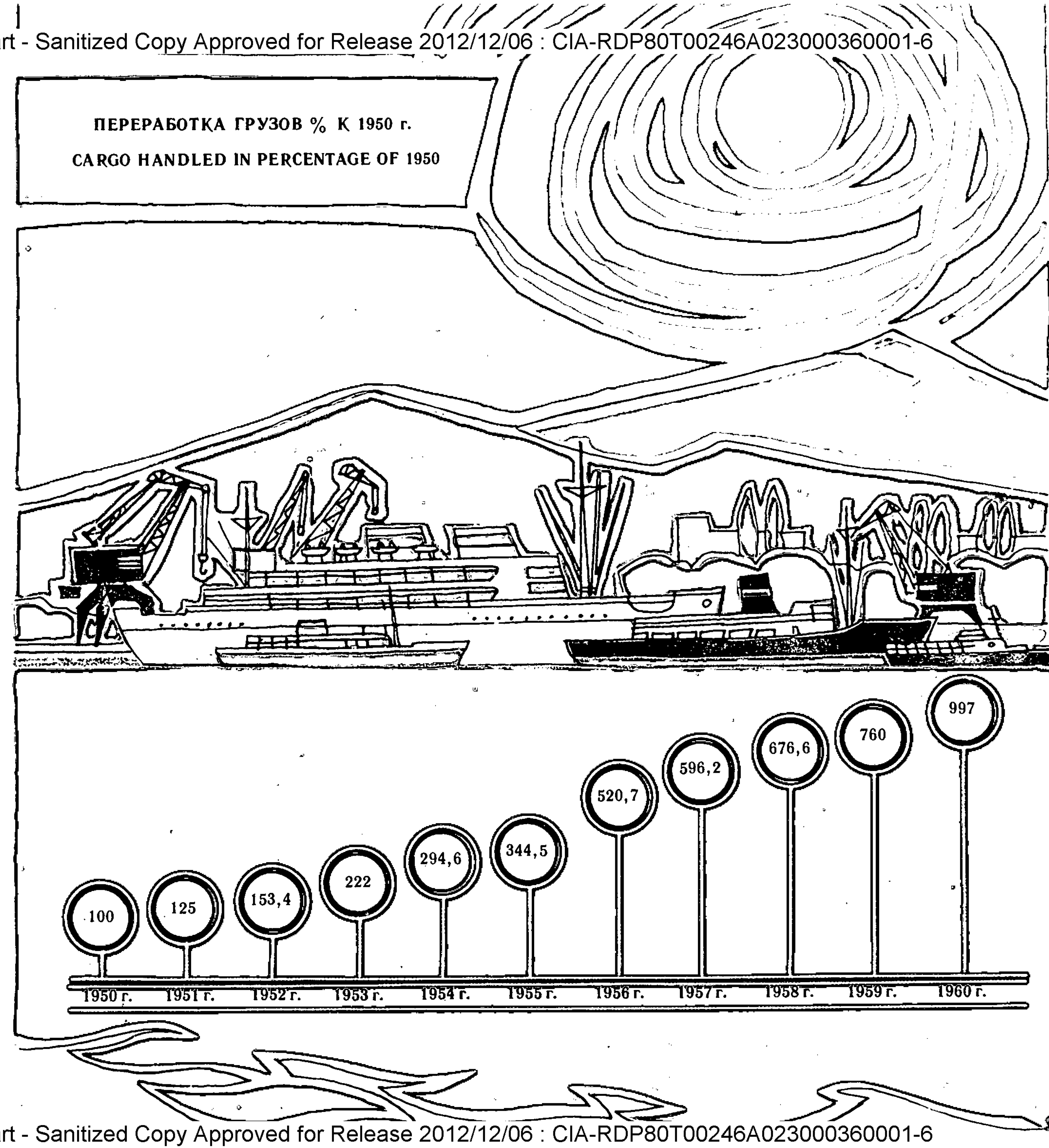
Порт занимается не только перевозками пассажиров, но и переработкой грузов. Весь Южный берег Крыма снабжается строительными материалами, топливом и различными продовольственными и промышленными товарами через Ялтинский морской порт.

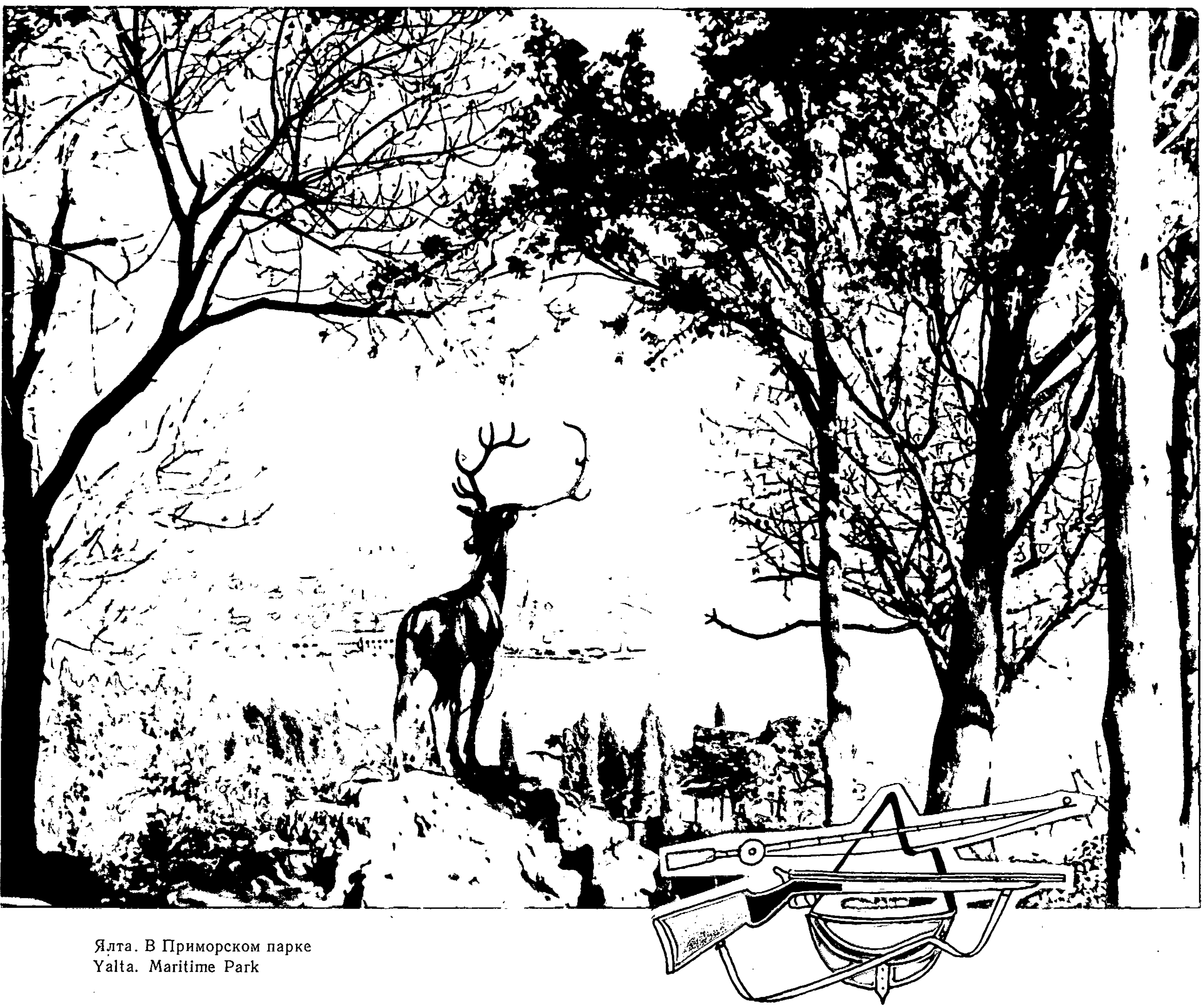
The port of Yalta has deep moorages that can accommodate ocean liners and freighters.

The port handles cargo as well as passengers. Building materials, fuel and other commodities for the whole southern coast of the Crimea pass through the port of Yalta.

ПЕРЕРАБОТКА ГРУЗОВ % К 1950 г.

CARGO HANDLED IN PERCENTAGE OF 1950





Ялта. В Приморском парке
Yalta. Maritime Park

Чарующая красота края, сочетание вечнозеленой растительности с голубым морским простором, теплый, мягкий климат — все это создает прекрасные условия для полноценного отдыха.

Иностранные моряки и туристы, посещающие Южный берег Крыма, имеют возможность близко ознакомиться с условиями труда и быта советских людей и убедиться, что советский народ желает мира и процветания всем народам.

The enchanting beauty of the coast, with its emerald-green vegetation and blue sea, and the warm, mild climate make the Crimea the ideal place for a holiday.

Foreign seamen and tourists visiting the southern coast of the Crimea have every opportunity to gain a firsthand knowledge of the life and work of the Soviet people. They will see that the Soviet people want peace and prosperity for all nations.

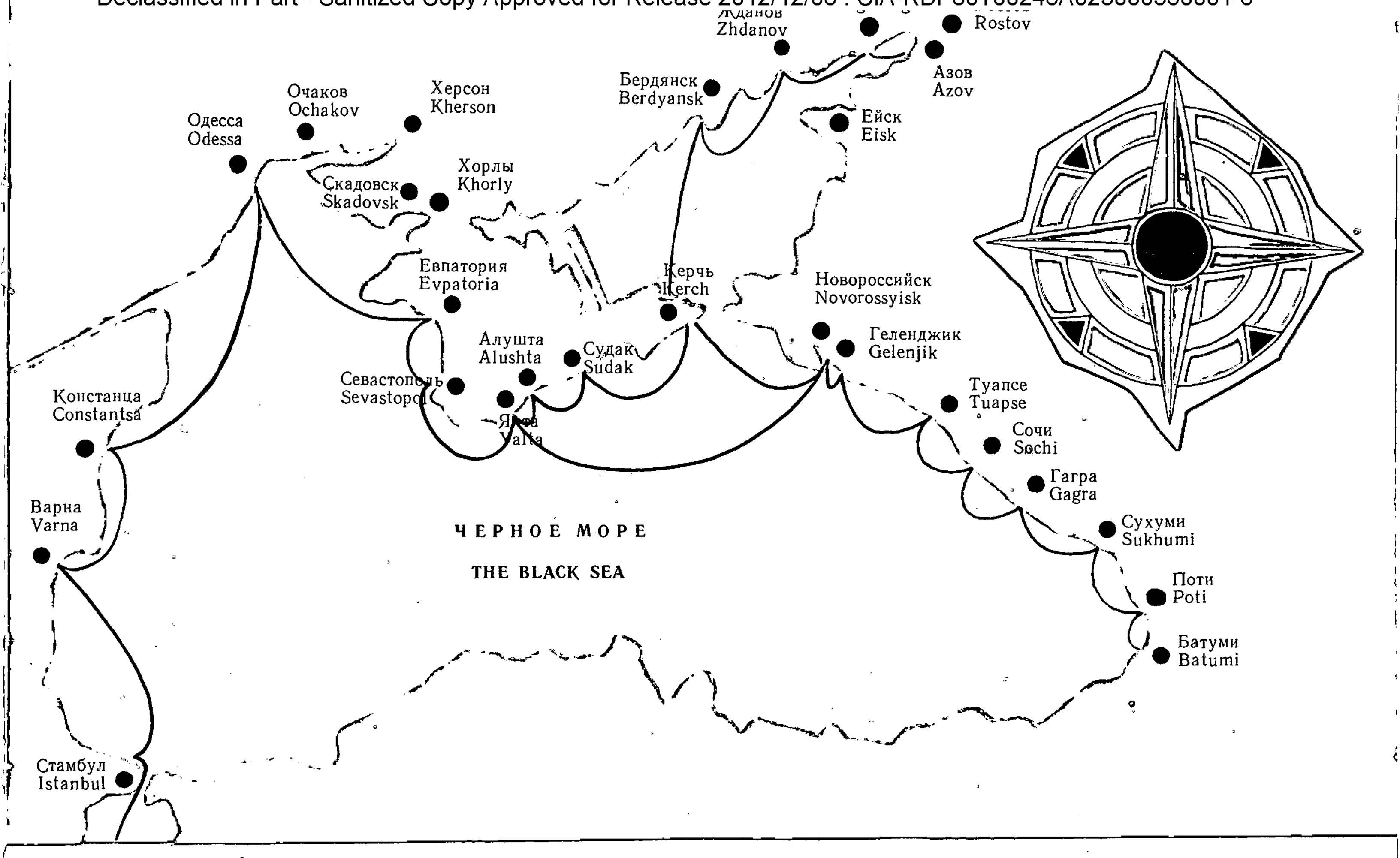
ОЯНИЯ ОТ ЯЛТЫ ДО НЕКОТОРЫХ ПОРТОВ МИРА

(в морских милях)

Александрия	1858
Амстердам	3501
Бомбей	4143
Бордо	3119
Бостон (Англия)	3518
Бостон (США)	5124
Бремен	3712
Буэнос-Айрес	7401
Гамбург	3722
Гданьск	4083
Иокогама	8999
Калькутта	5788
Лондон	3432
Мельбурн	8934
Нью-Йорк	5301
Порт-Саид	1097
Стокгольм	4236
Хельсинки	4370
Шанхай	8298
Марсель	1689
Пирей	663
Неаполь	1285
Осло	3987
Стамбул	314
Гибралтар	2111

DISTANCES BY WATER FROM YALTA TO:

Port	Naut. Miles
Alexandria	1,858
Amsterdam	3,501
Bombay	4,143
Bordeaux	3,119
Boston (Britain)	3,518
Boston (USA)	5,124
Bremen	3,712
Buenos Aires	7,401
Calcutta	5,788
Gdansk	4,083
Gibraltar	2,111
Hamburg	3,722
Helsinki	4,370
Istambul	314
London	3,432
Marseilles	1,689
Melbourne	8,934
Naples	1,285
New York	5,301
Oslo	3,987
Piraeus	663
Port Said	1,097
Shanghai	8,298
Stockholm	4,236
Yokohama	8,999



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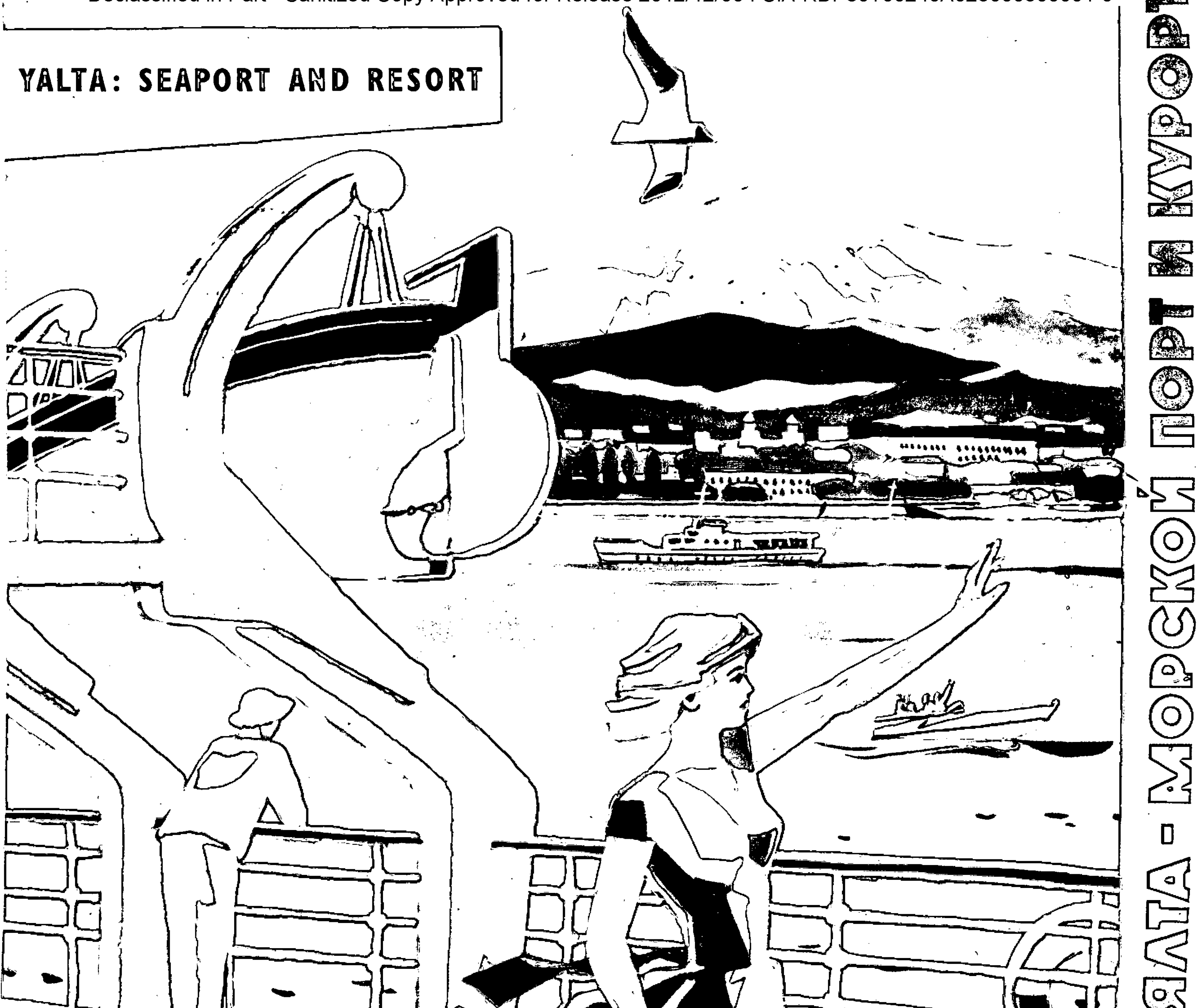

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