

**DEPARTMENT OF TRANSPORTATION  
UNITED STATES COAST GUARD**

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NVIC 8-84  
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NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 8-84

Subj: Recommendations for the Submittal of Merchant Vessel Plans and Specifications

- Ref: (a) Navigation and Vessel inspection Circular No. 10-82, "Acceptance of Plan Review and Inspection Tasks Performed by the American Bureau of Shipping for New Construction or Major Modifications of U.S. Flag Vessels"
- (b) Navigation and Vessel Inspection Circular No. 3-84 "Acceptance of Stability Related Review Performed by the American Bureau of Shipping for New U.S. Flag Vessels"


1. PURPOSE. The purpose of this Circular is to revise Navigation and Vessel Inspection Circular (NVIC) 6-79, "Coast Guard Review of Merchant Vessel Plans and Specifications", to reflect the procedures outlined in references (a) and (b), and to overcome deficiencies in NVIC 6-79.
2. DIRECTIVE AND. NVIC 6-79 is canceled.
3. DISCUSSION.
  - a. Titles 33 and 46 of the Code of Federal Regulations require certain plans and specifications regarding the construction and alteration of various types of vessels to be submitted to the Coast Guard for review. In the past, the majority of this plan review was conducted by the Coast Guard's field technical offices.
  - b. As a result of the agreement signed by the Coast Guard and the American Bureau of Shipping (ABS) on 27 April 1982, the Coast Guard expanded its acceptance of ABS plan review and inspection for vessels certificated by the Coast Guard and classed by ABS. The details of this agreement are contained in NVIC 10-82.
  - c. The Coast Guard will accept stability review performed by ABS for certain vessels receiving a load line assigned by ABS. The details of this acceptance are contained in NVIC 3-84.
  - d. The recommendations found in Enclosure (I) of this Circular apply to all plans that are submitted to the Coast Guard, or ABS, for those functions ABS performs on behalf of the Coast Guard. For ABS class requirements, ABS Circulars and ABS Rules should be consulted.
4. ACTION. All affected members of the marine community are urged to adopt and support the procedures outlined in this Circular.

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- a. Enclosure (1) contains Coast Guard recommendations regarding effective plan submittal procedures that would facilitate the review process. Plan submitters should ensure that plans submitted contain, as a minimum, the information listed in the enclosure. This should assure an orderly transmittal of necessary information. Since the Code of Federal Regulations addresses submittal requirements, enclosure (1) is provided only for guidance in determining the extent of information needed for plan review. For vessels classed by ABS, adherence to the provisions of NVIC 10-82 concerning plan review procedures is highly encouraged. For vessels receiving a load line assigned by ABS, the procedures of NVIC 3-84 may be utilized.
- b. To help eliminate unnecessary plan review, the following plan submittal policy is recommended:
  - (1) District Commander (mmt) offices or ABS, as applicable, in accordance with plan submittal recommendations found in enclosure (1), will review design non-working plans. Significant revisions to these plans should be submitted to the cognizant reviewing offices for approval action. Plan revisions should be directed to the same organization which approved the original drawings, in accordance with NVIC 10-82 or NVIC 3-84, and Enclosure (1).
  - (2) Reviewing offices may also review the original issue of key shipyard "working" plans, depending on the nature of the information shown on these drawings. These plans often show important information not shown on the design drawings. All subsequent revisions to the original shipyard "working" plans should be submitted directly to the Coast Guard resident inspector (if one is assigned to the shipyard), the cognizant Officer in Charge Marine Inspection, or to the local ABS surveyor, as appropriate, for action. The intent of this procedure is to screen plans to determine whether additional formal review and approval is necessary.
  - (3) All revised plans submitted for approval should clearly identify those areas modified from the previous revisions.
- c. District Commander (mmt) offices will not provide courtesy review of proposed designs. Informal question and answer sessions concerning the applicability of specific regulations or new concepts are, however, encouraged.
- d. The Coast Guard desires to review contract plans and specifications once it has become evident that a vessel (or class of vessels) will be built. This action will facilitate the development of working plans. A signed shipyard contract and the submission, as appropriate, of an application for inspection (CG Form 3752) to the cognizant officer in Charge, Marine Inspection will normally be indicative of an owner's intent to build.
- e. It is recommended that, unless specifically exempted by the Commandant, all vendor and subcontractor plans and specifications submitted to the Coast Guard be submitted through a single point (i.e. the prime contractor). The Coast Guard's experience with this procedure, notably with foreign construction and the foreign vessel letter of Compliance program, has shown the following benefits:
  - (1) The Coast Guard will be able to more effectively set plan review priorities for a vessel project by dealing with only one point of contact.

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- (2) Plan review is facilitated by reducing confusion, delays, and requests for additional information, and by minimizing the Coast Guard's involvement in disputes between owner, prime contractor and subcontractor.
  - (3) A reduction in the Coast Guard's involvement in paper management, and unnecessary and redundant plan review can be achieved by placing the burden of responsibility for an effective plan submittal (timing sequence, organization, compactness, and completeness) upon one owner-designated individual or group of individuals.
- f. All plans submitted to the Coast Guard for review action that do not contain required information will be returned without action to the submitter. The original submittal letter will be returned with an appropriate note indicating which plans referenced in the letter are returned.
- g. Those plans determined to be grossly at variance with the regulations, contrary to basic engineering principles, or in general not ready for review (i.e. illegible not in English, or diagrammatics without an attached bill of material, etc.) will be returned disapproved without itemized comments. The submitter will be referred to a major section of regulations or plan review policy as appropriate.
- h. As an incentive for submitters to identify and document, when practicable, previously approved design details (i.e. structure, arrangement, system components, etc.) to be incorporated into a new vessel project, the Coast Guard will place a higher priority on the review of such submittals. The most effective means of implementing this procedure would be to submit a copy of the drawing (showing the Coast Guard approval stamp) and/or a copy of the approval letter enclosed with the new vessel plan package. This will help reduce time delays caused by having to retrieve material from files which may not be readily accessible.
- i. Standard design booklets applicable to the practices of a particular shipyard (rather than a specific vessel as in 4.h. above) also can provide useful information that could save plan review time. If submitted to a District Commander (mmt) these booklets will be reviewed and kept on file for a period of no longer than five years.
- j. One copy of the approved plans are forwarded to the Officer in Charge, Marine Inspection in whose zone the vessel is being built. The approved plans are used by the local marine inspector to verify construction in accordance with the approved plans.
- k. Nothing herein shall be taken as amending applicable regulations, or as prescribing or limiting the authority and responsibility of the Coast Guard in requiring all information necessary in the review of merchant vessel plans.

  
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End: (1) Plan Submittal Recommendations

Non-Standard Distribution:

C:e Baltimore (45); Alameda (40)1 Port Arthur, Honolulu, Puget Sound (35); Miami, Mobile, Long Beach (25); Norfolk, Jacksonville, Portland OR (20); Boston, Portland ME, Charleston, Anchorage (15); Cleveland (12); Cincinnati, Louisville, Memphis, Nashville, Paducah, Pittsburgh, St. Louis, Savannah San Juan, Tampa, Galveston, Buffalo, Chicago, Detroit, Duluth, San Diego, Jureau, Valdez (10); Providence, Huntington, Wilmington, Corpus Christi, Toledo (5).

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D:l CG Liaison Officer MILSEALIFTCOMD M-65 STRAT MOB, CG Liaison Officer JUSMAGPHIL (1).

## PLAN SUBMITTAL RECOMMENDATIONS

This enclosure presents recommendations that will help streamline the plan review process for Coast Guard requirements. This discussion only addresses plan submittal for a generalized type vessel. Specific recommendations on certain specialized equipment (e.g. cryogenic applications, heavy lift vessels, mobile offshore drilling units, etc.) are not included. Reference to applicable code of Federal Regulations is required. The Coast Guard plan review process can handle most efficiently a submittal that presents only that information necessary to show compliance with the applicable regulations in a minimum number of plans.

The following sequence of plans attempts to identify and quantify the information necessary for an effective and efficient review. Depending on the type of vessel, not all of the plans may be required. Further, for some vessels such as a simple barge, it may be possible to combine the required information listed under several plans into only a few plans.

### GENERAL PLANS

Plans listed in this section present information which is used in all aspects of plan review: hull, stability, electrical and machinery. Also included are a few plans which do not fall into these categories.

1. Plan List - A detailed list of all plans prepared by the shipyard or designer should be submitted to all concerned parties at the beginning of the plan submission stage. The document should note to whom the plan will be submitted for review (Coast Guard (mmt), Coast Guard OCMI, ABS, etc.), and what action by the reviewing party is intended (approval, information only, etc.).
2. Specifications - The specifications should include a general description of the vessel and its functions.

#### Recommended Information:

- a. General vessel characteristics such as length overall, length between perpendiculars, breadth, depth, estimated deadweight, estimated gross tonnages (national and if applicable, international), estimated light-ship weight, lightship draft, load line draft, vessel speed, etc.
- b. Anticipated routes vessel will serve.
- c. Types of cargo to be carried.
- d. Classification society that will be "classing" the vessel. If the vessel is not "classed" identify the standards or approach used for scantling analysis.
- e. General description of main Systems such as propulsion, vessel control, electrical power generation and distribution, steering, navigational aids, cargo handling, ballast, fire protection, etc.
- f. Proposed manning level of ship including bridge and engine room.
- g. Number and category of persons to be carried.

- h. Degree of engineroom automation, if applicable, for a reduced manning level.
  - i. Required international certificates.
  - j. Required pollution prevention arrangements and installations.
3. General Arrangement Plan(s) - This plan should describe the entire vessel showing the watertight boundaries of the vessel, and the layout of each deck. This plan is used extensively in plan review for compliance with various regulations dealing with stability, access, required arrangements and accommodations. For many vessels this plan may be combined with the Safety Plan and Accommodation Plan described elsewhere in this Enclosure.

Recommended Information:

- a. Inboard Profile - shows the locations of all watertight transverse bulkheads, decks, and openings in these decks and bulkheads.
  - b. Outboard Profile - shows the profile of the vessel with the load line, design waterline, draftmarks, and bulkhead and freeboard decks indicated. For vessels carrying deck cargo a profile with deck cargo should be included. This information is used in calculations of required stability to meet wind heel criteria and to assess bridge navigational visibility.
  - c. Plan of each deck or space - for each deck all spaces should be shown. Openings that would be considered points of downflooding for the applicable intact and damage stability criteria should be indicated.
  - d. A reference system (usually based on frame numbers) should be used so that the locations of all tanks, holds, watertight bulkheads and can be determined for use in stability calculations and the locations of openings in watertight decks can be determined for downflooding.
4. Safety Plan (Fire Control Plan) - This plan shows the safety, fire protection, firefighting, and emergency equipment of a vessel. On most types of vessels this plan is required to be posted. Information on this plan is used by the in determining compliance with the many regulations on fire protection and emergency systems. An early submittal of this plan is necessary since the plan is used during the review of the subsystems referenced below.

Recommended Information:

- a. On a general arrangement type plan showing all spaces for each deck, the following information should be included, when installed:
  - (1) Control Stations - Continuously manned spaces where controls for emergency systems are located.
  - (2) Various fire sections enclosed by fire resisting bulkheads and the fire doors installed. All bulkheads and decks required to be "A" or "B" Class should be designated as such by symbols (e.g. A-60, A-30).

- (3) The location of alarm systems (CO<sub>2</sub>, halon, automatic sprinklers, fire detection, watertight doors, general).
  - (4) Location by type and medium, fire extinguishers (portable and semi-portable) and other applicable portable equipment.
  - (5) Arrangement of firemain system - Show the locations of the fire and their controls, the location of isolation valves in the system, and the fire stations.
  - (6) Fixed carbon dioxide and halon system, and locations of releases.
  - (7) Foam system showing the monitors and controls.
  - (8) Sprinkling system and location of controls.
  - (9) Fire detecting system showing location of monitors and spaces protected.
  - (10) Means of access to the different compartments and decks.
  - (11) Ventilation details in accommodations, control spaces, and passenger areas showing the location of ventilation fan shutdowns and fire damper controls, and numbers identifying each system.
  - (12) Location of lifesaving equipment (lifeboats, liferafts, buoyant apparatus, lifefloats, portable lifeboat radio, ring buoys, line throwing apparatus, life preserver stowage, EPIRB, signal flares, survival suits).
  - (13) Location of machinery stop stations (46 CFR 111.103-9).
  - (14) Location of international shore connection.
  - (15) Location of fireman '5 outfits.
  - (16) Location of combustible gas indicator.
  - (17) Location of and controls for watertight doors.
- b. Detailed recommendations on each subsystem above are beyond the scope of this NVIC. For further guidance see NVIC 6-80, "Guide to Structural Fire Protection Aboard Merchant Vessels", and NVIC 6-72 and Change 1, "Guide to Fixed Fire-Fighting Equipment Aboard Merchant Vessels".
5. Crew Accommodations Plan - The information in this plan is used to verify that the requirements for arrangement, means of escape, size, location, and equipment in the crew accommodation areas are satisfied in cases of unusual accommodation arrangements that require an amplifying plan. This plan should be in sufficient detail so that the size of the sleeping accommodations can be determined and the equipment installed can be verified. Washrooms, toilet rooms, mess rooms, hospital spaces and other spaces intended for recreation or crew use should be shown. For many vessels the General Arrangement Plans may be satisfactory for this purpose.

6. Shipboard Automation - The following comments are offered relative to the submittal of a shipboard automation package, particularly for reduced manning review. The plans required for approval by NVIC 1-69, "Automated Main and Auxiliary Machinery" should be submitted as a single package. In addition, the package should include diagrams of the systems addressed by NVIC 1-69.

Recommended Information:

- a. The process (or processes) being monitored and/or controlled, (i.e., fuel oil, lube oil, steam, feedwater, cooling water, air, hydraulics, firemain system, bilge system, circuit breakers, etc.).
  - b. All major components of the process (or processes), (i.e., tanks, reservoirs, valves, pumps, blowers, dampers, strainers, filters, heat exchangers, accumulators, etc.).
  - c. All major control and/or alarm system components for the process (or processes) involved, (i.e., sensors, transmitters, relays, control stations, interfaces, actuators, controllers, etc.).
  - d. A failure analysis should be submitted for all microprocessor based required control and alarm systems.
  - e. Additional information as deemed necessary by the submitter. Material specifications and other detailed information need not be included. These diagrams are to be used in conjunction with the automation plan review, and are to be provided for information only. Separate process system plans should be submitted for plan review as recommended elsewhere in this Enclosure.
7. Lifeboat Plan (Lifesaving Equipment Plan) - This plan shows primary lifesaving equipment on a vessel.

Recommended Information:

- a. Boats - Manufacturer, model, Coast Guard approval number, boat weight, and capacity.
- b. Rafts - Manufacturer, model, Coast Guard approval number, and capacity.
- c. Davits - Manufacturer, model, davit weight, and Coast Guard approval
- d. Buoyant apparatus - Manufacturer, model, Coast Guard approval number, and capacity.
- e. Designated rescue boat that is visible from bridge during launching -Manufacturer, model, and Coast Guard approval number.
- f. Winches - Manufacturer, model, and Coast Guard approval number.
- g. Falls.
  - (1) Size, materials.
  - (2) Breaking strength.



- (3) Factor of safety.
- (4) Length at 15 degree list (either side) and turns on winch.
- (5) Fleet angle (grooved or unproved drums).
- (6) Sheave diameter.
- h. Arrangements.
  - (1) Location of installations on vessel (recommended including a body view to show feasibility).
  - (2) Position of working space for winch operator.
  - (3) Deckplating, reinforcement, and stiffening foundations for davits.
  - (4) Adequate space at embarkation stations.
- i. Embarkation Ladder - Coast Guard approval number.
  - (1) Length at 15 degrees (either side).
  - (2) Location.
  - (3) Stowage.
  - (4) Attachment.
- j. Overboard discharges.
  - (1) Baffle plates or reach rods to shut-offs.
  - (2) Remote shut-down of pumps at boat lowering deck.
  - (3) Other means of closing openings.
- k. Embarkation lighting.
  - 1. Emergency Position Indicating Radio Beacon's manufacturer, model, Coast Guard approval number, and installed location.
- m. Stowage arrangement for portable lifeboat radio apparatus.
- n. Containers provided for life preservers and exposure suits (if any).
  - (1) location.
  - (2) Size.

- o. Line throwing appliance's manufacturer, model, and Coast Guard approval number.
- p. location of signal flares.

#### STRUCTURAL PLANS

Structural plans are generally reviewed in accordance with those classification rules acceptable to the Coast Guard. Plan submitters for vessels to be classed by ABS are encouraged to take advantage of NVIC 10-82. A significant reduction in Coast Guard review time can be achieved by following its procedures and submitting only those plans referenced in the NVIC. When scantling plans are not available, representative sections may be submitted. A structural submittal package should specify key design criteria (i.e. vessel dimensions, bulkhead locations, freeboard deck location, assumed weight of deck cargo, maximum density of liquid cargoes, height of overflow/vent, and other structural loadings assumed such as sealoads, slamming, etc.). Structural and welding details need not be itemized on each plan and can be referenced to the Booklet of Standard Details developed for each vessel. Shipyard standard details need to be submitted only if the Coast Guard does not have an approved copy on file, or if it contains revised details for the specific vessel under review.

- 8. Midship Section - A plan developing the hull-girder section modules amidships, depicting the continuous or effectively developed longitudinal members.

#### Recommended Information:

- a. Shell plating.
- b. Deck and inner-bottom plating.
- c. Longitudinal bulkheads.
- d. All longitudinal stiffeners and girders indicating those members not considered effective.
- e. Vessel characteristics: L, B, D, Cb, speed, design draft, maximum still water and wave induced bending moments
- f. Material identification (dimensions and grade).
- g. Corrosion allowance.
- h. Identification of local loadings (i.e. wheel loads, foundation loads, concentrated or distributed loadings.)
- 1. Frame spacing.
- j. Identification of cutouts.
- k. Identification of the "required" and "provided" overall section modulus and still water bending moment.
- 1. If required scantlings are reduced because of corrosion control measures, the required scantlings must be shown in parentheses beside the actual scantlings.

9. Construction Portfolio of Special Hull Materials - A plan detailing the location and installation of special materials.

Recommended Information:

- a. A simple plan adequately defining the location where each special hull material is used.
- b. Bill of material including chemical and physical properties of each special material.
- c. Approved weld procedures necessary for erection or repair of the special materials.
- d. Identification of prescribed quality assurance procedures.

10. Booklet of Scantling Plans - A series of key structural plans detailing the basic structure of a vessel. This series of plans should indicate scantlings, material specifications, corrosion control, stiffener end attachments, functional use of each structure, and a logical system of referencing data from the Booklet of Standard Details (if available).

Recommended Information:

The following plans can comprise the Booklet of Scantling Plans:

- a. Scantling plan/shell expansion (with identification of longitudinals and frames).
- b. Structural profile.
- c. watertight, oiltight and nontight bulkheads.
- d. Structural deck plans for strength decks.
- e. Inner bottom plating and framing.
- f. Typical sections for areas of unusual structure.
- g. Pillars and girders.
- h. Stem and stern frames, and rudder.
- i. Superstructure or deck house.
- j. Foundations for main machinery and boilers.
- k. Masts and kingposts.
- l. Ground tackle.
- m. Flume stabilization and dump tanks.
- n. Cross-flooding arrangements.

11. Booklet of Standard Details - A uniform specification on standard design details and specifications integrally coordinated to scantling plan development for a particular vessel or class of vessel.

Recommended Information:

- a. Welding details.
  - b. Inspection tolerances.
  - c. Structural details of panel stiffeners, brackets, scallops, openings in girders, structural intersections, chocks, tripping brackets, stanchion supports, stiffener endings, snipes. and cutouts.
  - d. General material specifications.
  - e. Bulkhead penetrations (ventilation, electrical, piping).
12. Arrangement of Ports, Doors and Airports - Those access penetrations of the side shell and decks that result in a reduction in local hull strength and/or increase a vessel's susceptibility to flooding.

Recommended Information:

- a. Arrangement and construction of access openings, reinforcements and/or compensations.
  - b. Means of closure.
  - c. Additional arrangements and construction details for doors, ports, airports, portlights, and deadlight covers may be necessary to meet load line and/or structural fire protection requirements.
13. Hatch Coamings and Covers in Weather and Watertight Decks - Those installations and devices necessary for the protection of deck openings in a vessel to preserve its weathertight or watertight integrity.

Recommended Information:

- a. Arrangements and construction details of hatch covers, hatch coaming, deck reinforcements, bearing surfaces, and fixed and portable hatch girders.
  - b. Material specification, and welding details.
  - c. Means of handling (operating) hatch covers and ensuring water/weather tightness.
  - d. Identification of assumed hatch cover design loads.
  - e. Deck hatch corner cutout details.
14. Sliding Watertight Doors and Operating Equipment - Those plans required for submission to Commandant (G-MTH) for watertight doors installed in subdivision bulkheads, or to a field technical office, for doors installed in non-subdivision bulkheads. Details covering the

arrangement, location, and construction of the door, frame, and control equipment for the purpose of meeting the requirements of 46 CFR 58.30, 111.97, and 163.001 to Commandant (G-MTH) - for doors in subdivision bulkheads. Details covering the arrangement, location, and control equipment for the purpose of meeting the requirements of 46 CFR 58.30 and the general electrical safety requirements in 46 CFR 111 (except these doors need not meet 111.97) to a field technical office -for doors in non-subdivision bulkheads.

15. Scuppers and Drains Penetrating Shell Plating - Those piping discharges used for maintaining adequate drainage of deck areas (weather, within super-structure or deckhouse) that penetrate the side shell plating.

Recommended Information:

- a. Arrangement of scuppers and drains including the location of all means to control backflooding (i.e. valves, controls, etc.).
  - b. Pipe and valve material specifications.
  - c. Details of through hull (deck and shell) connections including local reinforcement and welding details.
  - d. Height above the baseline.
16. Tank Vessel Loading Information - All tank vessels over 300 feet in length carrying bulk liquid cargoes regulated by Title 46 CFR subchapter D or Part 151 must have approved loading information to enable the master or person in charge to load and ballast the vessel in a manner that avoids unacceptable stresses in the vessel's structure if: (a) construction began on or after September 6, 1977; or (b) the vessel is assigned a load line and has the keel laid, or which is at a similar stage of construction, on or after July 21, 1968. The second condition is policy based on the strength consideration in 46 CFR 42.13-5 for existing vessels (46 CFR 42.05-30 (a)), and the recognized need for loading information for tank vessels over 300 feet long (46 CFR 31.10-32). A loading calculator may be employed to supplement the loading manual. A booklet or tabular form showing still water bending moment under lightship, full load, and various partial loading conditions is required. This should include stress limits and means to compute actual stresses for all allowable loading conditions listed in the Trim and Stability Booklet or Booklet of Operating Conditions. Stresses at deck and hull bottom should be shown. Maximum allowable still water moments and stresses should be indicated.
17. Cargo Gear Plans - Plans of cargo gear used in connection with loading and unloading of dry cargo include masts, stays, booms, winches, cranes, elevators, conveyors, and, standing and running gear, but does not include gear used for cargo hoses, ships stores, or rigging of vessels used in dredging, pile driving, drilling or construction work. The Coast Guard normally does not review cargo gear plans that have been approved by ABS or International Cargo Gear Bureau, and that are stamped and certified as cargo gear, except for those items covered by 46 CFR 58.30- Fluid Power and Control Systems, and 46 CFR 111 - Electrical Systems, General Requirements. Special cases include derrick barges rigged for heavy lifts, vehicle ramps, bow doors, cargo booms on self unloaders, oceanographic research vessels, and other specially designed vessels. Submission requirements for these special cases are determined by the OCMI

Recommended Information:

- a. Stress diagram with principle details of the cargo gear and supporting foundations.
- b. Diagram showing arrangements of the assembled gear and indicating the safe working load for each component part.

#### SUBDIVISION AND STABILITY PLANS

Stability requirements vary with vessel type, size, cargo, area of operation and the number of persons on board. Submitters should refer to 46 CFR Subchapter S for detailed requirements, and should consider the alternative procedures detailed in NVIC 3-84 available for certain types of vessels receiving a load line assigned by the American Bureau of Shipping. Computer generated data, where applicable, may be submitted and should clearly indicate the forward and after perpendiculars, and the location of amidships. Input/output data should be included along with an identification of the computer program (i.e. SHCP, STAAF, SCORES, etc.).

18. Lines Plans - The form of a ship's hull defined on a scaled drawing. Recommended Information:

- a. Three C3) views:
  - (1) Elevation or profile (sheer plan).
  - (2) A view looking down upon the ship (half-breadth plan).
  - (3) A set of transverse stations (body plan).
- b. An established base line noted on the drawing.
- c. Stations along the length with station spacing shown.
- d. Principle dimensions (LOA, LBP, molded beam, molded depth to main deck amidships).
- e. Identification of any unusual buoyant volumes included in the lines plan, such as shell appendages and superstructures.
- f. Frames along the length, including frame numbers.

19. Curves of Form (Displacement and other curves) - In anticipation of the vessel operating at many different drafts in the course of its service, the total displacement and certain other properties of the vessel's form are calculated and plotted at selected and parallel waterlines.

Recommended Information:

- a. On a diagram the following properties are plotted for various drafts:
  - (1) Displacement.
  - (2) Vertical center of buoyancy above baseline, KB.
  - (3) KMT - height of transverse metacenter above the baseline.

- (4) Longitudinal center of buoyancy, LCB, at a reference point.
  - (5) Longitudinal center of flotation, LCF, at a reference point.
  - (6) KMT. - height of longitudinal metacenter above the baseline.
  - (7) Tons per inch immersion, TPI.
  - (8) Moment to change trim one inch, MTI
- b. The datum point for draft and the various curves should be clearly stated.
20. Cross Curves of Stability - Presents righting arm values over the range of operating displacements for the following angles of heel: 5, 10, 15, 20, 25, 30, 35, 40, 50, and 60 degrees.
- Recommended Information:
- a. Assumed center of gravity.
  - b. Buoyant volumes included.
  - c. Initial trim.
  - d. Method of calculating righting arms - constant trim or constant trimming moment.
21. Draft Mark Locations - on site verification of the position of the draft marks by the OCMI or ABS surveyor is necessary.
- Recommended Information:
- a. Longitudinal locations of marks fore and aft referenced to the forward and after perpendiculars or to the nearest frames.
  - b. Vertical reference points.
  - c. Navigational draft marks should be based on the vessel's lowest vertical projection.
22. Capacity Plan - Describes capacities and locations of tank and cargo spaces
- Recommended Information:
- a. For the following spaces the vertical and longitudinal center of gravity, and capacity of each space shall be shown.
    - (1) Break bulk or bulk cargo holds.
    - (2) Spaces for the vessel's consumable goods.
23. Tank Sounding Tables - Indicates the volume in a tank corresponding to a vertical tank measurement.

Recommended Information:

- a. Tank tables of capacity in long tons versus soundings (or ullages) through the full depth of the tank for all tanks. The specific gravity or the density of the fluid in the tanks should also be included.
  - b. Vertical center of gravity, longitudinal center of gravity, transverse center of gravity, and free surface moment through the full depth of the tank for each tank.
24. Floodable Length Curve (Large and Small Passenger vessels) - A curve drawn upon the profile of a vessel. At each point the ordinate equals the maximum length of the vessel centered at that point that can be flooded without submerging the vessel beyond the margin line at an assumed permeability.

Recommended Information:

- a. Bulkhead deck, margin line, and subdivision draft.
  - b. Factors of subdivision (where required).
  - c. Permeabilities and calculations of reduced permeabilities when permitted.
  - d. location of equivalent main transverse watertight bulkhead.
  - e. Calculations of equivalent subdivision bulkhead locations (if applicable).
25. Intact Stability Criteria Calculations

Recommended Information:

- a. Calculations for intact stability criteria for the range of operating drafts intended (i.e. lightship draft to full load draft). The results of these calculations summarized as a graph of allowable KG or required GM versus draft.
  - b. For vessels which must meet weather criteria;
    - (1) Calculations for P, A, H, and T.
    - (2) If an increased value of T is used, the calculation for the increased value of T must be indicated.
  - c. For vessels which must meet a righting energy criteria, the angle of downflooding must be indicated.
26. Damage Stability Criteria Calculations

Recommended Information:



- a. Damage stability calculations for the maximum draft and trim, and the highest KG corrected for free surface anticipated. Revised damage stability calculations are required for any loading condition which exceeds the above parameters for which damage stability calculations are approved.
  - b. For cases of symmetric damage, the equilibrium draft and trim and the residual GM should be clearly indicated for each compartment or group of compartments considered.
  - c. For cases of asymmetric damage, the centerline draft and trim and the final angle of equilibrium should be clearly indicated. Alternatively, the deepest drafts at the forward and after perpendiculars and amidships should be shown. For passenger vessels, if the angle of equilibrium exceeds 7 degrees, the final angle of equilibrium, the range of stability, the maximum residual righting arm, and the area under the residual righting arm curve should be shown.
  - d. If equalization systems are used, calculations should be submitted with the damage stability calculations showing the time required for equalization.
27. Stability Booklet - Sets forth instructions and data necessary to permit an assessment of the vessel's stability, for any allowable condition of loading and operation (See 46 CFR 170.110).

Recommended Information:

- a. The following information is typical of what is provided in a stability booklet for the purpose of assessing a vessel's stability:
  - (1) A general description of the vessel, including lightweight data.
  - (2) General arrangement showing watertight compartments, the location of watertight closures and vents and the location of permanent ballast.
  - (3) Hydrostatic curves or equivalents.
  - (4) Tank capacity tables showing capacities of tanks, centers of gravity, free surface corrections, and instructions for applying them.
  - (5) Information on loading restrictions, such as a maximum KG or minimum GM curves and density limits on bulk liquid and solid cargoes
  - (6) Clear step-by-step instructions for computing the vessel's stability for each condition of loading and operation, and examples of loading conditions or alternatively specific allowable loading conditions.
  - (7) A brief description of the stability calculations done, including assumptions
  - (8) General precautions for preventing unintentional flooding.
  - (9) A table of contents and an index for the booklet.

- (10) Each ship condition which, if damage occurs, may require cross-flooding for survival, and information concerning the use of any special cross-flooding fittings.
  - (11) The amount and location of permanent ballast.
  - (12) Any other necessary guidance for the safe operation of the vessel under normal and emergency conditions.
- b. If the vessel is classed, the American Bureau of Shipping or other authorized classification society stamp should be affixed to that section of a stability booklet dealing with stress numerals and longitudinal strength. If the booklet is also to be reviewed by the Coast Guard, the stress numerals and longitudinal strength should be approved by the classification society prior to the submission of the booklet to the Coast Guard.

### ELECTRICAL PLANS

The information in this section on plan submittal is intended to clarify the required plan list in 46 CFR 110.25 of Subchapter J (Electrical Engineering Regulations). Information expected on each plan is indicated in order to provide for more expedient and efficient review. Each type plan will be explained separately, however the following general comments apply.

- a. When state of the art determinations of equivalency are requested and deadlines for ordering materials are near, the submitter should specify the methods and materials known to comply with the regulations.
  - b. For each system, item of equipment, or material that is submitted for approval, the submitter should review the Coast Guard regulations which may be applicable.
  - c. Numbers in parentheses generally refer to specific sections in Title 46 Code of Federal Regulations. Example: (111.50-5) would be 46 CFR 111.50-5.
28. Power System Package - The following information is a guide to be adapted to specific vessels.

#### Recommended Information

- a. Line Wiring Diagram of Power Systems.
  - (1) Generators.
    - (a) Continuous rating and power factor at specified temperature rise.
    - (b) Voltage and number of phases.
    - (c) Amperes at rated load.
    - (d) Generator connection (delta, wye, D.C. etc.).
  - (2) Cables - All types.

- (a) Circuit number or name.
  - (b) Cable type or designator, size, and UL listing information (if applicable).
  - (c) Cable banking and ambient temperature.
- (3) Circuit protective devices - circuit breakers & fuses.
- (a) Frame size and rated continuous current.
  - (b) Instantaneous and inverse-time trip settings.
  - (c) Special features such as undervoltage trip, motor operators, interlocks, auxiliary contacts, "K" factor, etc.
- (4) Switches.
- (a) Rated voltage.
  - (b) Rated continuous current.
  - (c) Rated interrupting current.
- (5) Batteries.
- (a) Type
  - (b) Nominal voltage.
  - (c) Capacity in ampere hours.
  - (d) Calculations to justify capacity based on load (113.25).
- (6) Motors.
- (a) Motor nameplate data.
  - (b) Motor starters.
    - 1. NEMA size or continuous rating, specify horsepower or ampere rating.
    - 2. Manual or automatic.
    - 3. Special features - LVR, LVP
    - 4. Integral or separate disconnect.
    - 5. Overcurrent unit identification and rating.

6. More than one source of potential.

- (7) Identify circuit breakers and motor starters with remote controls.
  - (8) Symbol list - Provide a complete symbol list or adhere to a specified national standard.
  - (9) Special construction - Indicate whether:
    - (a) Explosionproof - class, group, division, iden. code, testing laboratory approved.
    - (b) Dripproof or watertight.
    - (c) Corrosion resistant.
  - (10) Ground protection (detection) equipment.
    - (a) Switchboards.
    - (b) Transformer secondaries.
    - (c) Show type and detail.
  - (11) Transformers and reactors, as applicable.
    - (a) Primary and secondary voltage.
    - (b) Continuous KVA ratings at self cooled rise.
    - (c) Winding connection.
    - (d) Overcurrent protection.
  - (12) For branch and feeder circuits, describe the connected load (amperes) or other basis for sizing cable.
  - (13) Panelboards (power, lighting and interior comms)
    - (a) Name or identification.
    - (b) Circuits supplied.
    - (c) Rating of energy consuming devices.
- b. Summary of Short Circuit Analysis.
- 1 Abbreviated impedance one line diagram; including all sources, major contributors and fault locations.

2 Table of data or assumptions.

(a) Generators.

1. KVA and voltage rating.
2. transient and subtransient reactance.
3. X/R ratio and speed, if necessary.
4. Power factor.
5. Connection (wye, or delta).

(b) Induction motors and induction motor groups.

1. Horsepower and voltage.
2. Subtransient reactance or motor code letter.

(c) Synchronous motors.

1. Horsepower, voltage and power factor.
2. Transient and subtransient reactance.
3. Power factor.

(Note: Lumped sum motor data may be provided for (b) and (c) above.)

(d) Transformers.

1. KVA rating.
2. Winding connection, tap settings.
3. Impedance or base KVA.
4. Primary and secondary voltage rating.
5. Nameplate impedance.
6. X/R ratio, if available.
7. Method of grounding.

(e) Cables.

1. Size.

2. Length.

3. Impedance at system frequency.

- (3) Calculation particulars.
- (a) Cite method, explain computer programs briefly.
  - (b) State assumptions, including bases.
  - (c) Tabular summary of results for selected faults showing I" symmetrical and asymmetrical and I' symmetrical.

c. Protective Device Coordination Analysis.

- (1) Identify on a separate impedance one line diagram all significant circuit interrupters.
- (2) Data table of protective device ratings, including trip settings, interrupt and withstand ratings, etc.
- (3) Time/current curves for each significant circuit interrupter.
- (4) Coordination plot for selected branches and feeders.
  - (a) Locate constraints on time/current curve.
    1. Device starting and running current.
    2. Available fault currents.
    3. Cable and transformer allowed current.
  - (b) Indicate protective device settings and manufacturer<sup>1</sup> 8 identification of selected trip devices.
  - (c) Coordination should be downstream between generator and feeder circuit breakers.
  - (d) Coordination downstream of feeder circuit breakers should be provided to the maximum extent feasible.

d. Electric Plant Load Analysis.

- (1) Ships Service load Analysis.
  - (a) Total connected load from nameplate horsepower or kilowatt ratings.
  - (b) Total peak load - For automated machinery spaces the bridge started fire pump generally has an assigned load factor of one, as does all other

equipment which is automatically started without regard to spinning reserve.

- (c) Average loads may be provided if desired, but generator capacity is compared to necessary "ship's service loads"(111.10-l(a)).
  - (d) A diversity factor may be applied to other peak loads if assumptions implicit in the application of factor can be met.
  - (e) Duty factor is applicable only to automatically cycled devices.
  - (f) Show sample calculations.
  - (g) Discuss automatic load shedding with : or ABS, as applicable, at the conceptual stage.
- (2) For emergency power load analysis use load factor at 100% for each item of connected load including all spares at 100%.
  - (3) For general alarm or I.C. battery load analysis - show calculations based on 46 CFR 113.25-6.

29. Switchgear -

Recommended Information:

- a. Front and rear views.
- b. Switchboard wiring diagram should show details of ground detection.
- c. Bill of material with manufacturer's name and identification of switch gear, instruments, relays, transformers, etc.
- d. Required and selected size of bus bars (111.30-19). Show calculations of ampacities for various bus locations with regard to locations of generators.
- e. Show calculations to verify bus bracing to prevent damage from the maximum available short circuit current.
- f. Identify switchboard wiring materials, insulation type, size, and stranding.
- g. Metering and automatic switchgear.
  - (1) If this impacts the load analysis, then discuss at conceptual stage.
  - (2) Elementary wiring diagram.
  - (3) Block diagram.
  - (4) Description of operation.

30. Diagram of Electric Installations in Hazardous locations

## Recommended Information:

- a. Introduction - The primary function of U.S. Coast Guard review of electrical installations on vessels with hazardous locations is to limit installation of electrical equipment in these areas to only those items which are absolutely necessary. Where it is necessary to install electrical equipment in hazardous locations, review will focus on ensuring that the type of equipment and the installation method will provide safe operation. Accordingly, extra attention is necessary to verify that only explosionproof or intrinsically safe equipment listed by an independent testing laboratory recognized by the Commandant is installed in hazardous locations or that the equipment is purged and pressurized in accordance with NFPA 496, as required by Subchapter J. [Note: The National Electric Code, and Subchapter J allow certain electrical equipment in Division 2 areas to be other than explosionproof, intrinsically safe, or purged and pressurized. Submitters should address such equipment.]
- b. An initial step prior to submittal of regular electrical plans should be taken by the designer of the vessel with the submission of a general arrangement type drawing titled "Electrical Installations in hazardous locations." This drawing should:
  - (1) Distinguish hazardous locations as discussed in 46 CFR 111.105 from safe locations; identify hazard class, division and group identify circuits and circuit functions in hazardous locations.
  - (2) Distinguish between explosionproof equipment, intrinsically safe Systems, and purged and pressurized Systems. The use of the words "equipment" and "system" is not arbitrary. Explosionproof components can be reviewed and accepted if their location onboard the vessel is known. Intrinsically safe and purged and pressurized equipment should be reviewed on a system, rather than a component, basis.
  - (3) Include a bill of material which lists all electrical equipment in the hazardous areas. The bill of material should be keyed to the general arrangement drawing to indicate:
    - (a) location on drawing and circuit identification.
    - (b) Explosionproof intrinsically safe or purged and pressurized.
    - (c) Type of equipment (motor, seal fitting, junction box, etc.).
    - (d) Remarks (watertight, dripproof, corrosion resistant, etc.)
    - (e) Temperature identification number or surface temperature if applicable for explosionproof equipment. Refer to National Electric Code Table 500-2(b).
    - (f) Manufacturer and manufacturer's model number.



- (g) The independent testing laboratory listing or report number.
- (h) A copy of the independent testing laboratory report should be submitted for intrinsically safe Systems since these reports frequently include restrictions or limited applicability.

Items (3) (a)-(h) should be included, to the extent known, with the initial drawing submission. Reserved information should be submitted and approved prior to final approval of the drawing.

- (4) For explosionproof utilization devices, indicate the location of control equipment, even if located in safe locations. This includes disconnect devices, motor controllers, and intrinsically safe control systems.
- (5) For intrinsically safe systems indicate the equipment items which comprise each separate system. The location of the safety amplifier, zener barrier, etc., should be indicated. Indicate what each intrinsically safe system measures or controls. Indicate isolation of wiring from other shipboard electrical systems.
- (6) Show the following if applicable:
  - (a) Standard installation methods including orientation of seal fittings relative to explosionproof equipment.
  - (b) Grounding details or barriers in intrinsically safe Systems. Caution: Must be compatible with power system ground.
  - (c) Details of shaft seals for gastight bulkhead penetrations.
  - (d) Details of ventilation fans in hazardous locations to comply with 46 CFR 111.105-21.
- (7) In general, only the manufacturer, in accordance with an approved schedule, can make penetrations in an explosionproof box. Any field drilling will weaken the structure and will void the independent laboratory approval (think of the box as a pressure vessel during explosions). However, field alterations are acceptable if done in accordance with the manufacturers instructions and the testing laboratory approval.

- c. Purpose and Submission of Drawing - This general arrangement drawing of each item of electrical equipment that is in a hazardous location and the bill of material keyed to the drawing via symbols are necessary to coordinate the large amount of detailed information which should be checked to ensure safe operation. The general arrangement drawing should include a profile view where height above the deck is important. General arrangement implies that the drawing is scaled so that distance can be determined.
- d. Approval - Vendors information will not be stamped "approved". A comment in the letter to the plan submitter will indicate whether or not the item is acceptable for the applications shown on the Electrical Installation in Hazardous locations drawing.

Approval of all equipment will be indicated by the final approval of the Electric Installations in Hazardous Locations drawing and bill of material after all reservations are removed and all of the comments are satisfied.

31. Approval, Listing, and Compliance - As stated in 46 CFR 110.25-1, certain equipment must meet referenced standards and specifications. Compliance with these requirements may be attained by the manufacturer certifying compliance, independent testing laboratory listing or labeling, or USCG/ABS review. Other equipment must be approved or accepted by the Commandant, and must be reviewed by the Commandant to be acceptable for use. Equipment addressed by 46 CFR Subchapter Q are included in this category. Equipment for use in hazardous areas must be listed and labeled to be acceptable, that is, it has been designed, and tested, to a recognized standard and covered by a follow-up program. It is important to note that equipment that must meet a standard need not be listed.

### MACHINERY PLANS

The following guidance discusses recommended procedures for the submission of plans for approval of piping systems, materials, and equipment in shipboard systems. To facilitate the review of any shipboard machinery related system a clear, logical, and complete presentation is necessary.

32. Piping Systems - A piping diagrammatic will be acceptable for both the diagrams required by 46 CFR 56.01-10(c)(1) and the arrangement drawings required by 46 CFR 56.01-10(c)(2), provided locations of all components and piping runs are indicated. The only exceptions to this will be systems requiring thermal analysis (main steam) or those systems which require flow calculations (firemain and foam). In these cases the arrangement drawing may still be eliminated if a three dimensional isometric providing necessary details for performing the required analysis is provided on or with the diagrammatic.

A bill of material should be provided and keyed to the applicable drawing. It should include the following information:

- a. Device or component (i.e., pipe, valve, fitting, etc.)
  - b. Type, size, quantity, design standard, and rating of valve, flange or fitting.
  - c. Applicable material or component specification selected from 46 CFR 56.60 (i.e., ASME, ANSI or acceptable ASTM specification).
  - d. Wall thickness and diameter of pipe.
33. One suggested method of displaying this information can be found on Appendix A. For certain drawings, such as firemain and foam systems, curves (or capacity tables) are required and can conveniently be located on the applicable drawing. Most engineering piping systems installed aboard vessels are complex. A logical means of identifying and presenting the individual systems is necessary. The following ordered list is one example:
- a. Diagram of the specific system requiring approval (See 46 CFR 56.01-10).
  - b. Drawings of individual components in a system requiring approval (See Table 46 CFR 50.25-1(a)).

- c. Bill of Materials, containing the information outlined in 46 CFR 56.01-10(d)(1). Again see Appendix A.
- d. Information showing compliance with 46 CFR Subpart 56.50- Design Requirements Pertaining to specific Systems.
- e. Information showing compliance with 46 CFR Subparts::
  - (1) 56.07- Design
  - (2) 56.10- Components
  - (3) 56.15- Fittings, Bends, and Intersections
  - (4) 56.20- Valves
  - (5) 56.25- Pipe Flanges, Blanks, Flange Facings, Gaskets, and Bolting
  - (6) 56.30- Selection and Limitations of Piping Joints
  - (7) 56.70- Welding
  - (8) 56.75- Brazing
  - (9) 56.80- Bending and Forming
  - (10) 56.85- Heat Treatment of Welds
  - (11) 56.90- Assembly

Materials must generally be in accordance with an acceptable specification (i.e. ASME Code, specifications required within ANSI component standards, 46 CFR Table 56.60-1 or 46 CFR Table 56.60-2). The specifications of materials that do not comply with these standards will be considered by the Coast Guard on an individual basis. Most reviewed piping systems require components to be made from materials which have had physical and chemical properties tested.

INFORMATION FOR DRAWINGS AS REQUIRED BY 46 CFR 56.01-10(d)  
(Suggested Format)

ITEM NO.	QTY. REQ.	DESCRIPTION (include manufacturer, press/temp. rating, short description, size, design std., whether welded, seamless, cast, forged, etc.)	SERVICE	SYSTEM DESIGN PRESSURE (MWP) AND TEMPERATURE	MATERIAL (Material Specification, includes Grade or Type, i.e. ASTM A53 Type F, See 46 CFR 56.60)	REMARKS
P-1	500	1/4" O.D. x .035 wall seamless tube	Air	149 PSI/ 150°F	ASTM B-88 Type K	
V-1	2	Waltham 150# Globe Valve, 3/4", Model #38 (ANSI B16.34)	Fresh Water	149 PSI/ 150°F	ASTM B-61	Mill Certs Required*
F-1	50	NIBCO 90° Ell, 3/4", (2000 psi), ANSI B16.22	Air	60 PSI/ 100°F	ASTM B-62	Mill Certs Required*
F-2	20	Taylor Forge 2" -300# Weld Neck Flange (ANSI B16.5)	Hydraulic	600 PSI/ 200°F	ASTM A-181 GR. 1	
M-1	1	Apex Centrifugal Pump, Model X-23, 150 gpm 75" TDH	Fresh water	35 PSI/ 150°F		

\* The Coast Guard adopts via 46 CFR 56.60 only certain ASTM materials, most are ASME. ASME specifications are similar to ASTM specifications of the same number except for various modifications, as appropriate. In many cases the only difference between ASME and ASTM specifications is that ASME requires mill certs. Thus, the ASTM specifications may be acceptable as equivalent to its ASME counterpart if mill certs. are required by the purchaser.