



Guide for
Ships Burning Coal

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Foreword

This Guide has been prepared to make available the Bureau recommendations for handling and burning coal as a primary source of power for ships. Burning coal in ships is not new: indeed coal was used more than a century ago. Modern coal handling on ships, while relatively new, is of proven technology as evidenced by the self-unloading bulk carriers. What is new, however, is the use of modern coal burning technology on ships and the operation of modern mechanized coal handling systems while at sea.

When coal burning systems are installed in a vessel classed with the Bureau, details of the systems are to be submitted to the Bureau and they are generally expected to be fitted in accordance with this Guide.

Guide for Ships Burning Coal

1.0 Application

This Guide is intended to apply to ships burning coal in boilers having stoker and grate arrangements. Other forms of coal burning such as pulverized fuel, underfeed firing, and fluidized beds require special consideration. It is expected that pulverized fuel systems will be of the direct firing type (the bin system is not to be employed) and that the provisions of NFPA 85E, 85F, and 85G will be followed for such installations.

2.0 Plans and Data

The following plans and data are to be submitted in triplicate for review.

Coal specifications including size, grindability, volatility, moisture, ash content and foreign matter

Machinery Arrangement

Operating and Maintenance Manual

Arrangement plans showing coal bunkers, transfer system, preparation equipment, boilers and ash handling system

Plans of bunkers

Details of control, safety, instrumentation and alarm systems including arrangements, schematics, panel layouts and description of operation

Coal transfer system

Details of stokers and grates

Ash handling system

Plans of ventilation systems for bunkers and spaces where coal is handled

Plans showing hazardous locations and electrical equipment in these locations together with the manufacturer, model and enclosure type

3.0 Operating and Maintenance Manual

An Operating and Maintenance Manual is to be provided. The Manual is to contain plans and descriptions of coal bunkers, handling systems, preparation systems, burning systems and ash removal systems, together with operating instructions for lighting off, normal, and emergency conditions, and recommended maintenance.

4.0 General

Coal storage, transfer, preparation, burning, and ash removal systems are to be arranged so that a single failure of any active component or a bunker fire will not cause loss of more than 50% of steam production necessary for the propulsion and safety of the ship and preservation of the cargo. Generally, this will necessitate at least two storage bunkers, two transfer systems, duplicate coal preparation equipment, two service bunkers, two boilers, and duplicate ash removal equipment. Two boilers need not be fitted where a boiler is provided with burning equipment, including draft fans, and ash removal systems which satisfy the single failure principle.

5.0 Coal Conditions

Coal transfer, preparation and burning equipment, furnaces, and boiler, superheater and economizer tube spacing are to be designed for satisfactory operation over the full range of coal conditions specified by the Owner.

6.0 Environmental Conditions

Coal transfer, preparation, burning, and ash removal systems are to be able to operate satisfactorily when inclined at angles of list up to and including 15 degrees and angles of roll up to and including 22½ degrees together with pitch angles up to and including 7½ degrees.

7.0 Bunkers

Bunkers are to be in locations which will not cause heating of the coal from such sources as steam boilers and elevated temperature cargo. Generally, the internal surfaces of bunkers are to be smooth; structural members are to be outside of bunker plating in order to prevent accumulation of coal and dust within the bunker. Consideration will be given to structural members inside of bunkers where the arrangements are such that the flow of coal will not be impeded, e.g. smooth vertical members and horizontal members arranged in shedding manner. The thickness of plating in bunkers is to be increased by 1.5mm (0.06 in.) above that required by the Rules and is not to be less than 9.5mm (0.375 in.) in bottoms and sides of bunkers.

Bunkers and coal handling systems are to be designed so that there are no dead spots in the bunker, i.e., the coal flow will be such as to enable the bunker to be completely emptied. In order to comply with this requirement it is generally expected that bunkers will have sloped bottoms, the angle of the sloped bottom relative to the horizontal being not less than 45 degrees for bunkers with low friction linings and 70 degrees where such linings are not provided.

Gates, valves, or other suitable means of closure are to be installed in bunker outlets to provide a tight seal.

Effective drainage of bunkers is to be provided. Drainage may be to the bilges in compartments below bunkers or may be provided by the ship's bilge main. Non-return valves with positive means for closing are to be provided in bilge and drain pipes to prevent ingress of water from the bilge system or from one bunker to another.

Arrangements are to be fitted for the offloading of storage bunkers.

8.0 Independent Manual Control

Means are to be provided for independent manual control in the event of failure of a particular control in the coal transfer, preparation, burning, ash removal, and boiler control systems. Necessary instrumentation and communications are to be provided so that satisfactory operation under independent manual control can be exercised for lengthy periods. Independent manual control is to be demonstrated during tests or trials to the satisfaction of the Surveyor. This is to include demonstration of independent manual control through the full maneuvering range and transfer from automatic control.

9.0 Coal Transfer Preparation

Except for tunnel spaces dedicated to coal transfer facilities, coal transfer and preparation is to take place in enclosed air tight ducts, pipes or equipment. Tunnel spaces for coal transfer are to be separated from other spaces by air tight boundaries. Means are to be provided for observation of the coal flow. Accesses are to be provided to facilitate servicing of enclosed equipment, cleaning, clearing obstructions and sampling coal. Pipes and ducts are to be no less than 9.5mm (0.375 in.) thick except for pipes of nominal size 254mm (10 in.) and smaller which may have a thickness corresponding to ANSI Schedule 40. Where automatic transfer to a day bunker is provided, the transfer is to be stopped automatically when the bunker is full. All metallic components of the coal transfer and preparation systems are to be effectively bonded (grounded) to the ship's hull. Upon failure of one section of a transfer system the upstream portions of the system which are in series with the failed section are to stop automatically. The transfer system is to be provided with means to prevent foreign substances from entering transfer, preparation or burning equipment which could be damaged by such foreign substances. Means for removing foreign substances need not be provided if the coal specifications preclude foreign material which can stop flow or damage equipment. Consideration is to be given to provisions for breaking coal bridges in bunkers and blockages in the transfer and preparation systems.

10.0 Boiler Control

Control of coal feed from day bunkers, spreaders, draft fans and dampers, overfire air flow, ash removal and feedwater is to be provided in the vicinity of the boiler front together with adequate instrumentation to permit effective utilization of these controls. Flue gas oxygen content monitors and grate temperature monitoring systems are to be provided. Boilers intended to operate without manual supervision are to comply with the applicable requirements of 41.41 through 41.51 of the "Rules for Building and Classing Steel Vessels" and the boiler control system, including the steam dump system, is to operate automatically. The boiler controls are to provide the capability to safely satisfy the steam requirements demanded from the boiler under all conditions ranging from maximum steam generation to maneuvering while maintaining the fuel-air mixture within the limits required for continuous combustion. The boiler control system is to be capable of operation during maneuvering such that the safety valves will not lift; it is generally expected that a steam dump system will be fitted to provide this capability. Means are to be provided to prevent backflow of furnace gases to stokers which are not in operation.

11.0 Boiler Protection System

A boiler protection system is to be provided. Interlocks are to be provided to prevent operation of induced draft (I.D.) fans without proper operation of forced draft (F.D.) fans and their dampers. In the case of low boiler water level, the coal feed is to be automatically stopped. Failure alarms are to be provided for feed systems from day bunkers, coal supply controllers, spreader motors and grate drive motors. Low level alarms are to be provided for day bunkers. Additionally, the protection system is to provide the following automatic safety actions which are to be alarmed.

<i>Condition</i>	<i>Safety action²</i>
High furnace pressure ¹	Trip coal feed & F.D. & I.D. fans
Low furnace pressure ¹	Trip coal feed & F.D. & I.D. fans
F.D. fan malfunction	Trip coal feed & I.D. fan
F.D. fan damper not open	Trip coal feed & F.D. & I.D. fans
I.D. fan malfunction	Trip coal feed & F.D. fan
I.D. damper not open	Trip coal & F.D. & I.D. fans

Notes

- 1 A suitable time delay is to be provided to prevent tripping of the boiler due to transients which do not present a hazard.
- 2 Tripping of I.D. and F.D. fans is to be properly programmed to avoid high or low furnace pressure conditions. Limits may be different for tripping the fuel supply and tripping the fans.

12.0 Dual Fuel

Systems designed to burn both oil and coal, either separately or simultaneously, are to be provided with indications showing what

fuel is being fired. Automatic oil systems used to ignite coal are to comply with Section 41 of the "Rules for Building and Classing Steel Vessels."

13.0 Ash Handling and Storage

Ash handling systems having the capability to remove the maximum quantity of ash which may be produced are to be provided. Handling and storage systems are to be arranged so that heat is not transmitted to bunkers. Materials used for wet handling and storage systems are to be corrosion resistant or protected from corrosion.

14.0 Ventilation

Ducts and pipes for ventilation of bunkers, coal handling spaces, ducts for coal transfer systems and other spaces where coal dust is expected to be present are to be independent of any other ventilation system. Exhaust ducts of such systems are to terminate on the open deck. Where a mechanical exhaust is provided, a filter is to be placed in the system before the fan and as close as practicable to the source of dust. Natural exhaust ducts are to be arranged as vertically as practicable with no angle being greater than twenty degrees from the vertical in order to avoid accumulation of coal dust in the vents.

Bunkers are to be effectively ventilated with unrestricted air flow over the entire coal surface. The ventilation and structural arrangements are to be such that there are no dead spots where gas may accumulate. A ventilation system is to be provided for each bunker. Ventilation openings are to be fitted with permanent means for closure and the position of the closure devices are to be clearly indicated.

15.0 Fire Protection

The fire main system is to be such that at least two jets of water can reach any part of an empty bunker space, and any coal handling space. Two readily accessible easily operable air tight accesses are to be provided at the top of each bunker.

16.0 Electrical Installations

Electrical installations in hazardous locations are to be limited to those considered essential for operational purposes. Hazardous locations are subdivided into Category A, Category B, and Category C locations. Category A locations are those where both coal dust and methane may be present. Category B locations are those where coal dust is expected to be present in the atmosphere but methane is not expected. Category C locations are those where coal dust will not be expected in the air in ignitable or explosive quantities but where some accumulations of such dust are expected. Electrical cable

installed in these locations is to be armored or MI type. Electrical equipment in hazardous locations is to comply with the following.

Category A

Location

Coal bunkers, ventilation ducts from coal bunkers and preparation equipment and within 3m (10 ft) of outlets of such ducts

Equipment

To be certified for use in coal dust and methane atmospheres

Category B

Location

Compartments where coal is dropped or dumped; open locations within 3m (10 ft) of a coal transfer point where coal is dropped or dumped; inside closed conveyors

Equipment

To be certified for use in coal dust atmospheres

Category C

Location

Compartments containing open conveyors

Equipment

Watertight equipment having an enclosure whose maximum temperature does not exceed 165C (329F) for equipment not subject to overloading, and 120C (248F) for equipment subject to overloading; receptacles are to be of a type that prevents making or breaking contact with live parts exposed

17.0 Tests and Trials

Satisfactory operation of the complete installation is to be demonstrated to the Surveyor during trials. This is to include all coal handling and utilization systems as well as ash handling systems. It is to be demonstrated that a single failure of an active component of these systems will not cause loss of more than 50% of steam production necessary for propulsion and safety of the ship and preservation of cargo. Satisfactory operation of the systems during maneuvering is to be demonstrated.