CATERPILLAR®

3600 Marine Engine Application and Installation Guide

- **Repowering Applications**
- **Other Applications**

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Repowering Applications

General
Foundations
Repower Survey Check List

Repower Applications

General

This section covers areas for a repower application review. Specific systems or equipment sizing and selection are described in greater detail in other guide sections.

Operation, maintenance, and overhaul accessibility is a prime concern in the arrangement of propulsion plants. This is especially true in repowers where space is often limited. For example, when locating the main engines in the aft end of the engine room, adequate space must be provided around the marine gear for periodic inspections, maintenance, and foundation girder locations. When arranging an engine room for repowering, the piping, ventilation ducts, wireways, and other equipment associated with the new propulsion plant must be carefully reviewed. New equipment functional requirements and its relationship with existing equipment is important regarding equipment supervision, inspection, overhaul, and maintenance.

Once the general location of the main engine or engines has been established and the reduction gear design decided on (vertical or horizontal, offset or inline) the vertical centerline of the engine and reduction gear can be determined. The engine and reduction gear foundation can then be designed. See the foundation description at the end of this section.

Trade-offs between auxiliary components selected and available installation space are sometimes required. The choice between horizontal or vertical pumps is an example. Horizontal pumps require more space to install, but are easier to overhaul and support. They tend to be less expensive to purchase. In heat transfer equipment, the choice between shell and tube or plate type is primarily a function of space and cost.

Existing auxiliary equipment such as ballast and bilge pumps, fire pumps, fuel oil transfer pumps, general service pumps, etc., are normally located in the lower engine room. This equipment will usually remain and must be considered when locating the new propulsion plant.

Depending on the extent of equipment located at the floorplate level, a new intermediate deck between the floorplate and the existing upper engine room deck may be required. The new deck can be used to locate the diesel generators, starting air compressors, switchboard, engine control room, etc.

The existing engine room ducting must be reviewed for installation, inspection, and maintenance of the engine exhaust pipes and exhaust services. Space must also be allowed for ventilation and intake air ducting.

Removal of large machinery components must be possible. In many repowers a hatch and lifting arrangement is provided. In others, components are removed through existing access rooms. Locate lifting gear and workshop equipment for the maintenance and overhaul of the main propulsion engines, diesel generators, and fuel treatment plants.

Adequate space must be provided for operating areas and access around the propulsion plant. The following are minimum requirements:

- The headroom in all working and walking areas should be at least 1.9 m (6 ft 3 in.).
- The width of main access passages in the engine room should be at least 915 mm (36 in.). Secondary, or infrequently used passageways, may be 610 mm (24 in.) wide.
- The width of main access ladders should be 685 mm (27 in.) and the angle of slope 60 degrees. The slope of infrequently used ladders may be greater if acceptable to the owner or the classification societies.

- The width of vertical ladders to infrequently used intermediate levels should be 380 mm (15 in.).

Develop several designs before selecting a final machinery arrangement offering the best combination of cost, performance, and accessibility for operation and service.

Consult the ship owner or operator to determine if the ship's operating profile or trade route will change after the repower is completed. If a change is contemplated, review the following points:

- *Operating environment* - An anticipated increase in ambient air and sea water temperatures can have an impact on the operation of existing machinery. It may require equipment replacement or size increases. Temperature increase also affects operating alignment.
- *Circulating water* - A ship designed for fresh water, but operated in sea water, will experience accelerated corrosion and increased maintenance of circulating pumps, heat exchangers, valves, fittings, and piping.
- *Ventilation and access openings* - If a ship originally designed to operate in coastal waters is modified and converted to operate in ocean waters, the ventilation, combustion air, and access openings may have to be relocated. This ensures no ingress of sea water from increased wave height.
- *Classification* - If the ship is classed by a classification society or governmental agency, the repowering may be considered to be a major conversion and many other areas of the ship may require upgraded machinery to meet regulations. The possible increased cost should be made known before proceeding.
- *Generating Plant* - The existing plant must have capacity to handle additional electrical loads resulting from the repower. An increase in the ship's electrical plant may be required.
- *Automation* - In many repowers, the engine room automation level is changed from manned to one man or to unmanned. Review classification society and/or governmental agency requirements for the engine room manning level.
- *Handling* - A ship's survey should include a review for removing the existing power plant and the requirements to transport the new engine into engine room position. This may include cutting the decks or side shell and temporarily removing other equipment, piping, and/or electrical items.
- *Stability* - The repowering of a large ship may not impact the ship's stability. In a small ship the new engine's weight and vertical and longitudinal centers of gravity may lead to marginal ship stability. It may become necessary to add permanent fixed ballast in the inner bottom to compensate for appreciable differences in the weights and centers of gravity.
- *Torsional analysis* - Perform a torsional analysis based on the new propulsion drive line arrangement and new operating parameters. This calculation could impact the decision to reuse or replace the shafting or propeller.
- *Drive shafting* - The shaft horsepower and/or the rpm may change with the repower. Check the existing shafting stresses. Shafting calculations may require a classification society and/or government agency's submittal.

A tabulation of information required during a survey of the ship to be repowered is included at the end of this section. The list will assist in engine room design, selection of necessary auxiliary machinery and piping, and electrical system arrangement.

Foundations

With some exceptions, the principles discussed in the *Mounting and Alignment* section are applicable for repowers.

When retaining the existing marine gear, the input shaft height and fore and aft positions are known. This determines the location for the torsional coupling and/or flywheel on the engine. It establishes the fore and aft location and height of the engine mounting feet (with chocking allowances) and the engine girder top flange.

When installing a new gear, the engine and gear box position must be determined. Once known, review the position of the gear box and engine mounting feet relative to the existing mounting flange. Not only changes to the existing foundation must be known, but also the effect of modifications to the double bottom structure. Existing foundation girders cannot arbitrarily be moved without providing suitable replacement double bottom structure aligned with foundation girders.

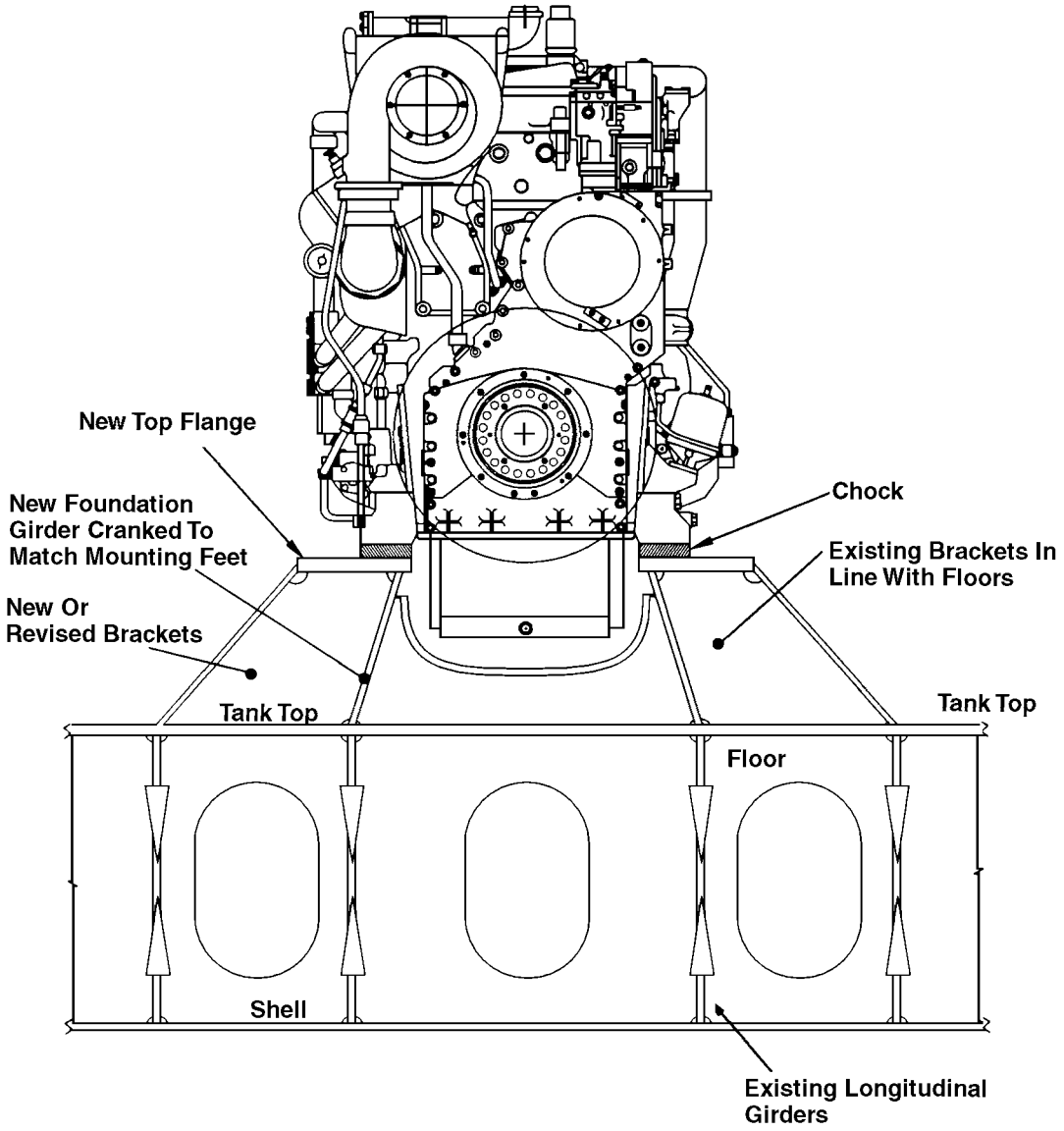
Minimize ship structure modifications and when possible, change only the structure above the tank top. Frequently it will be possible to alter the existing structure rather than construct a new foundation.

The ideal engine foundation design positions the foundation girders directly under and vertically in line with the engine mounting feet. This arrangement is generally not possible in a repower due to different spacing of engine mounting feet. The foundation girders may require cranking (sloping) to match engine mounting feet. Keep the engine girder base in line with the longitudinal structure in the double bottom as shown in Figure 1.

Cranking or sloping the foundation girders is a viable option if an integral engine/gear box foundation can be accommodated. When the engine foundation is cranked, the modified girders must eventually tie back into the longitudinal girders of the gear box foundation. When a new gear is installed, review the locations of both the engine and gear box mounting feet to keep modifications to the engine and gear box foundation structure minimal. Each repower will produce unique modifications due to differences in engines and foundations.

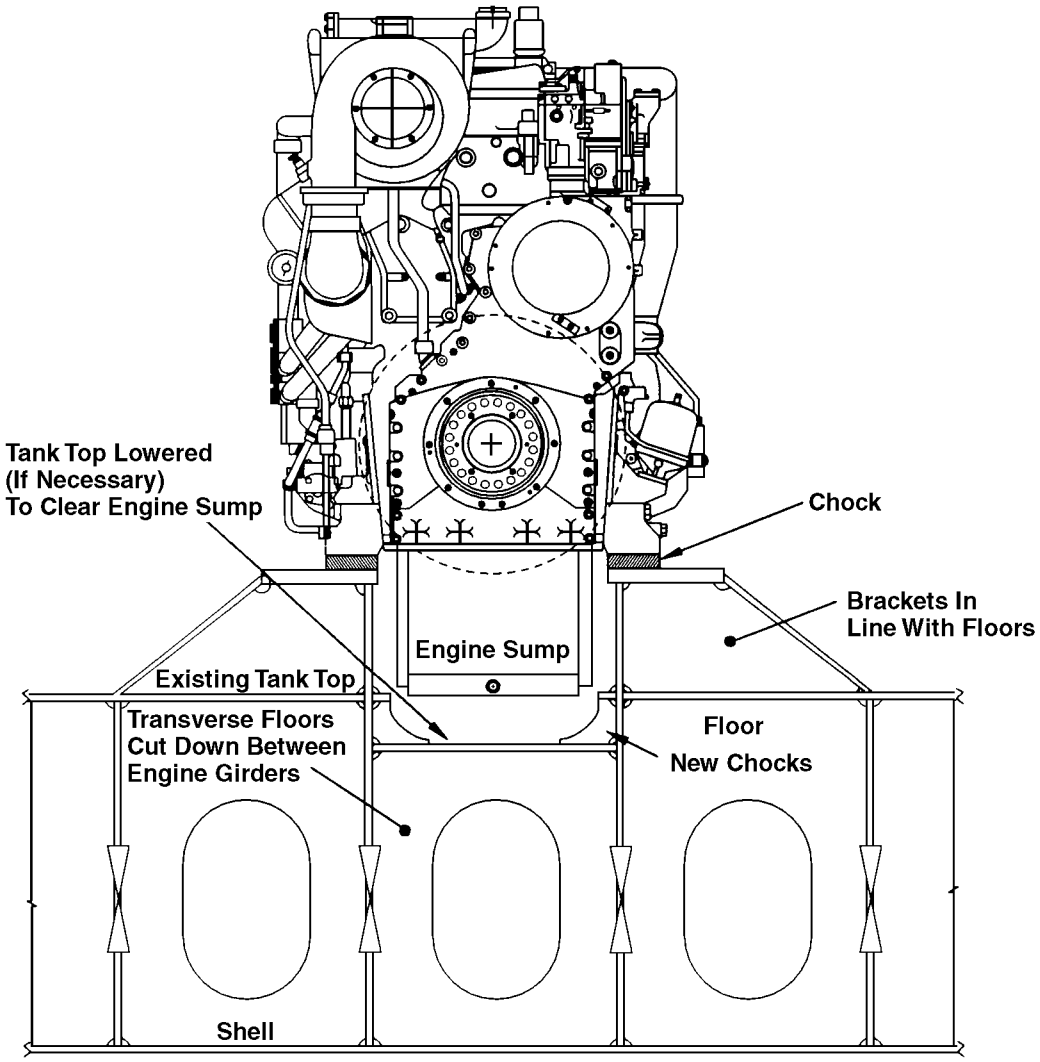
Clearance must be allowed between the engine sump and existing tank top elevation. Depending on the ship design, the engine sump and new gear box bottom may interfere with the existing tank top of the ship. This must be recognized early in the process to eliminate, or at least reduce, the interference. One option is to cut away the tank top and relocate it downward between the two foundation engine girders as shown in Figure 2. This involves cutting floors in the double bottom and perhaps the addition of ship's structure to retain continuity of the existing structure. Small chocks may be necessary between the two girders when the tank top offset becomes more than a few centimeters (inches).

A second option is to install new foundation girders sloped out from the engine centerline to match the engine mounting feet. Attach new girders to existing girders below the tank top level. They can generally be sloped far enough from the engine centerline to provide adequate clearance for the engine sump and still mate up to the engine mounting feet. Figure 3 is a typical engine foundation section with new girders.



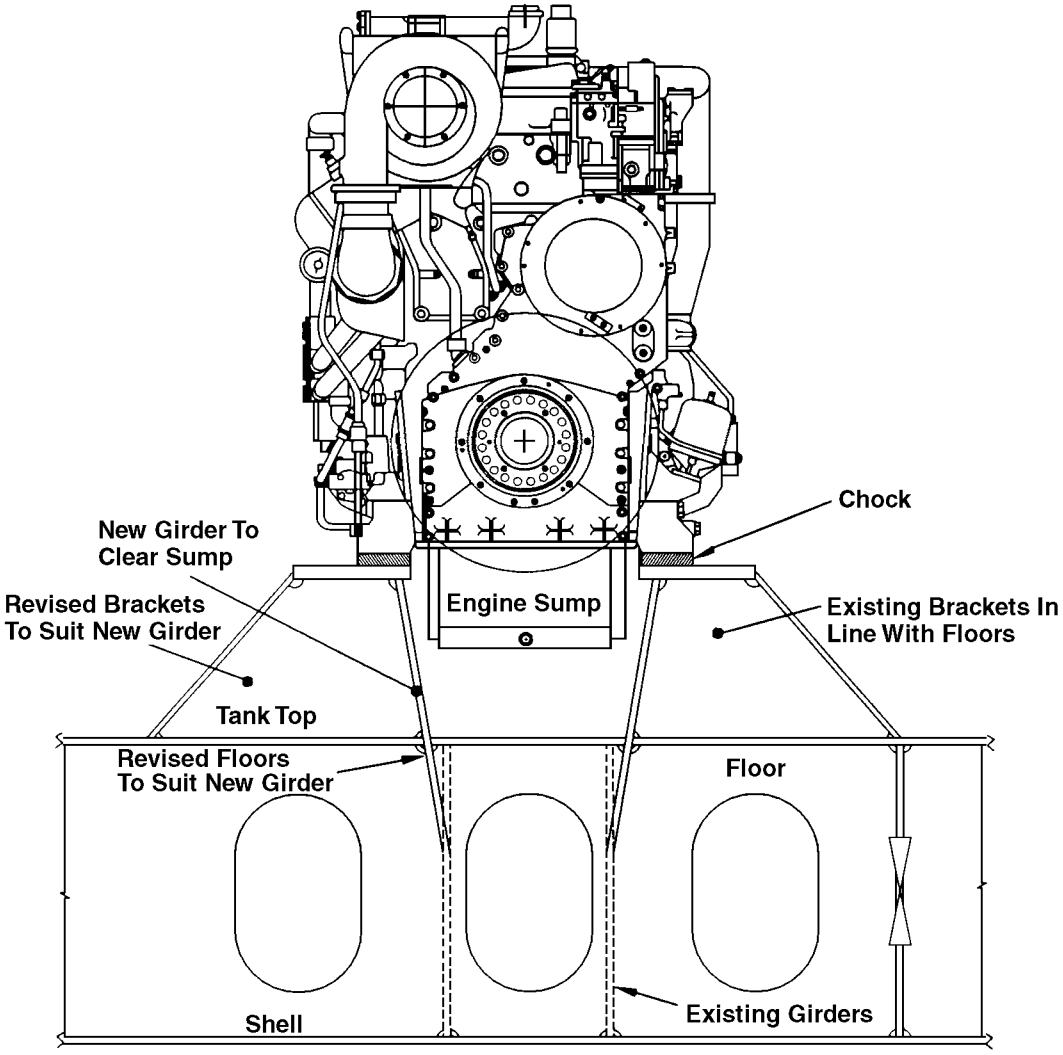
Typical Section
Sloped Girders

Figure 1



Typical Section
Lowered Tank Top

Figure 2



Typical Section
Foundation Modification To Clear Sump

Figure 3

REPOWERING SURVEY CHECK LIST

SHIP NAME: _____

OWNER: _____

_____

_____

_____

_____

TELEPHONE: _____

FAX: _____

DATE: _____

LOCATION: _____

TIME: _____

SHIP DATA

Existing Dimensions		**Remarks:**
Length, O.A.	m (ft.)	
Length, B.P.	m (ft.)	
Beam, Molded	m (ft.)	
Depth	m (ft.)	
Draft	m (ft.)	
Speed @ loaded draft	knots	

Where Built:		
Location		
Year		
Hull No.		

MAIN ENGINES

Manufacturer		**Remarks:**
Number installed		
Type		
No. of cylinders		
Bore x Stroke	mm (in.)	
Brake horsepower, MCR	kW (hp)	
BMEP	kPa (psi)	
Speed	rpm	
Fuel type		
Chocking type		

REDUCTION GEAR

Main Reduction Gear		**Remarks:**
Manufacturer		
Type		
Input speed	rpm	
Output speed	rpm	
Design horsepower	kW (hp)	
Chocking type		

Torsional Couplings		
Manufacturer		
Number installed		

Clutches:		
Manufacturer		
Number installed		
Type		
Operating pressure	kPa (psig)	

SHAFTING & PROPELLER

Line Shaft		**Remarks:**
Material		
Diameter (approx.)	mm (in.)	
Tail Shaft		
Number installed		
Material		
Diameter (approx.)	mm (in.)	
Thrust Bearing		
Manufacturer		
Number installed		
Type		
Bearing Pressure	kPa (psig)	
Line Shaft Bearing		
Manufacturer		
Number installed		
Type		
Stern Tube Bearing		
Manufacturer		
Number installed		
Type		
Propeller		
Manufacturer		
Number installed		
Type		
Material		
Diameter (approx.)	m (ft.)	
Number of blades		
Design horsepower	kW (hp)	
CPP Hydraulic Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Motor size	kW (hp)	
Stern Tube Lube Oil Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Motor size	kW (hp)	

SHAFTING & PROPELLER

CPP Hydraulic Tank		**Remarks:**
Number installed		
Head	kPa (psig)	
Capacity	liters (gal.)	

Stern Tube		
Number installed		
Type		

Seals		
Manufacturer		
Number installed		
Type		

Shaft Brake		
Manufacturer		
Number installed		
Type		

Provide sketch of existing lineshafting, tailshaft, bearings, etc.:
(include dimensions)

Provide sketch of propeller aperture:
(include dimensions)

FUEL OIL SYSTEM

Heavy Fuel Oil Purifier Heater		**Remarks:**
Manufacturer		
Number installed		
Type		
Capacity	kg/hr (#/hr)	
Oil inlet temperature	°C (F°)	
Oil outlet temperature	°C (F°)	
Steam pressure	kPa (psig)	
Pressure drop, oil	kPa (psig)	
Fouling factor		

Diesel Oil Transfer Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor Size	kW (hp)	

Heavy Fuel Oil Booster Pump		
Manufacturer		
Number installed		
Type		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor Size	kW (hp)	

Diesel Oil Booster Pump		
Manufacturer		
Number installed		
Type		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor Size	kW (hp)	

Fuel Tanks		
Heavy fuel oil tank	(Capacity)	# of tanks:
Diesel oil tank	(Capacity)	# of tanks:
Blend oil settling tank	(Capacity)	# of tanks:
Blend oil day tank	(Capacity)	# of tanks:
Diesel oil settling tank	(Capacity)	# of tanks:
Diesel oil day tank	(Capacity)	# of tanks:

FUEL OIL SYSTEM

Heavy Fuel Oil Purifier		**Remarks:**
Manufacturer		
Number installed		
Type		
Capacity (approx.)	L/hr (gph)	
Discharge pressure	kPa (psig)	
Oil viscosity (@ 50°C)	SSU	
Oil inlet temperature	°C (F°)	

Diesel Oil Purifier		
Manufacturer		
Number installed		
Type		
Capacity (approx.)	L/hr (gph)	
Discharge pressure	kPa (psig)	
Oil viscosity (@ 50°C)	SSU	
Oil inlet temperature	°C (F°)	

Booster Pump Heaters		
Manufacturer		
Number installed		
Type		
Capacity	L/hr (gph)	
Oil inlet temperature	°C (F°)	
Oil outlet temperature	°C (F°)	
Steam pressure	kPa (psig)	

Booster Pump Filters		
Manufacturer		
Number installed		
Type		
Capacity	L/min (gph)	
Filter ratings		

LUBRICATING OIL SYSTEM

Main Engine L. O. Purifier		**Remarks:**
Manufacturer		
Number installed		
Type		
Capacity (approx.)	L/hr (gph)	
Discharge pressure	kPa (psig)	
Oil viscosity (@ 50°C)	°C (F°)	
Oil inlet temperature	°C (F°)	

Main Engine L. O. Purifier Heater		
Manufacturer		
Number installed		
Type		
Capacity	L/hr (gph)	
Oil inlet temperature	°C (F°)	
Oil outlet temperature	SSU	
Steam Pressure	kPa (psig)	

Main Engine L. O. Suction Strainers		
Manufacturer		
Number installed		
Type		
Capacity	L/min (gpm)	
Screen Openings		

Main Engine L. O. Coolers		
Manufacturer		
Number installed		
Type		
Lube oil	L/min (gph)	
Oil inlet temperature	°C (F°)	
Oil outlet temperature	°C (F°)	
Tube diameter and thickness		
Tube and tube sheet material		
Shell and baffle material		
Fouling factor		

L.O. Temperature Control Valves		
Number installed		
Type		
Temperature setting	°C (F°)	

Main Engine L. O. Discharge Strainers		
Number installed		
Type		
Capacity	L/min (gpm)	

LUBRICATING OIL SYSTEM

Main Engine L. O. Filters		**Remarks:**
Number installed		
Type		
Capacity	L/min (gpm)	

Main Engine L. O. Sump Tank		
Number installed		
Type		
Capacity	liters (gal.)	

Main Engine L. O. Storage Tank		
Number installed		
Type		
Capacity	liters (gal.)	

Main Engine L. O. Settling Tank		
Number installed		
Type		
Capacity	liters (gal.)	

Main Reduction Gear L. O. Cooler		
Number installed		
Type		
Lube oil flow (approx.)	L/min (gpm)	
Lube oil inlet temperature	°C (°F)	
Lube oil outlet temperature	°C (°F)	
Sea water temperature	°C (°F)	
Material		
Lubricating oil cooler	liters (gal.)	

Main Reduction Gear L. O. Discharge Strainer		
Number installed		
Type		
Capacity	L/min (gpm)	
Screen Mesh		

Main Reduction Gear L. O. Sump Tank		
Number installed		
Type		
Capacity	liters (gal.)	

Main Reduction Gear L. O. Storage Tank		
Number installed		
Type		
Capacity	liters (gal.)	

LUBRICATING OIL SYSTEM

Main Reduction Gear L. O. Settling Tank		**Remarks:**
Number installed		
Type		
Capacity	liters (gal.)	

Auxiliary Engines L. O. Storage Tank		
Number installed		
Type		
Capacity	liters (gal.)	

Main Engine L. O. Service Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Reduction Gear L. O. Service Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Stern Tube L. O. Service Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

SEA WATER SYSTEMS

Oil/Water Separator		**Remarks:**
Manufacturer		
Number installed		
Capacity (approx.)	L/min (gpm)	
Bilge and Ballast Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	
Engine Room Bilge Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	
Ballast Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	
General Service Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	
Sea Water Circulating Piping		
Type		
Material		
Size	mm (in.)	
Diameter of Sea main	mm (in.)	

SEA WATER SYSTEMS

Sea Water Circulating Pump		**Remarks:**
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Sea Water Service Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Fire Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Emergency Fire Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Priming Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Suction	mm (in.)	
Motor size	kW (hp)	

Desalination Plant		
Manufacturer		
Number installed		
Type		
Capacity	m^3/day (gpd)	
Evap. feed temp.	°C (°F)	
Steam supply pressure	kPa (psig)	

SEA WATER SYSTEMS

Sea Water Strainer		**Remarks:**
Manufacturer		
Number installed		
Type		
Size	mm (in.)	

Sea Chests		
Number installed		
High?		
Low?		

Sketch general locations of sea chests:

FRESH WATER SYSTEMS

Main Engine Jacket Water Coolers		**Remarks:**
Manufacturer		
Number installed		
Type		
Jacket water flow	L/min (gpm)	
Sea water flow	L/min (gpm)	
Jacket water inlet	°C (F°)	
Jacket water outlet	°C (F°)	
Sea water temp.	°C (F°)	
Tube diameter and thickness		
Shell and baffle material		
Head, tube sheet, and tube component material		
All wetted parts in contact with sea water		
Maximum sea water velocity	m/sec (ft/sec)	
Fouling factor		

Jacket Water Temperature Control Valve		
Number installed		
Type		
Temperature setting	°C (°F)	

Jacket Water Expansion Tank		
Number installed		
Type		
Capacity	liters (gal.)	

Auxiliary Water Coolers		
Manufacturer		
Number installed		
Type		
Fresh water flow	L/min (gpm)	
Sea water flow	L/min (gpm)	
Fresh water inlet	°C (F°)	
Fresh water outlet	°C (F°)	
Sea water temp.	°C (F°)	
Tube diameter and thickness		
Shell and baffle material		
Head, tube sheet, and tube component material		
All wetted parts in contact with sea water		
Maximum sea water velocity	m/sec (ft/sec)	
Fouling factor		

FRESH WATER SYSTEMS

Cooling Water Temperature Control Valve		Remarks:
Number installed		
Type		
Temperature setting	°C (°F)	

Jacket Water Cooling Pumps		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	m (ft)	
Motor size	kW (hp)	

Auxiliary Water Cooling Pumps		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	m (ft)	
Motor Size	kW (hp)	

Storage Type Hot Water Heater		
Manufacturer		
Number installed		
Type		
Storage capacity	liters (gal.)	
Capacity output	L/hr (gph)	
Water inlet	°C (°F)	
Water outlet	°C (°F)	
Steam pressure	kPa (psi)	

Fresh Water Hydropneumatic Tank		
Manufacturer		
Number installed		
Type		
Capacity	liters (gal.)	
Design pressure	kPa (psi)	

Fresh Water Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

Hot Water Circulating Pump		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	L/min (gpm)	
Head	kPa (psi)	
Motor size	kW (hp)	

FEED AND STEAM DRAIN SYSTEM

Drain and Inspection Tank		**Remarks:**
Number installed		
Type		
Capacity	liters (gal.)	

Boiler Feed Pumps		
Manufacturer		
Number installed		
Type		
Drive		
Capacity	liters (gal.)	
Head	m (ft)	
Motor size	kW (hp)	

STEAM GENERATING PLANT

Heat Recovery Silencer		**Remarks:**
Manufacturer		
Number installed		
Type		
Working pressure, steam	kPa (psig)	
Outlet capacity	kg/hr (#/hr)	

Main or Auxiliary Boiler		
Manufacturer		
Number installed		
Type		
Working pressure	kPa (psig)	
Total evaporation	kg/hr (#/hr)	

AIR CONDITIONING MACHINERY

Air Conditioning Compressor		**Remarks:**
Manufacturer		
Number installed		
Type		
Condensing temperature	°C (°F)	
Capacity	tons	
Motor size	kW (hp)	

Air Conditioning Condenser		
Manufacturer		
Number installed		
Type		
Condensing temperature	°C (°F)	
Sea water inlet temperature	°C (°F)	

Air Conditioning Receiver		
Number installed		
Type		
Pump-down capacity (approx.)	%	

SHIP'S SERVICE REFRIGERATION

Refrigerated Stores Compressors		**Remarks:**
Manufacturer		
Number installed		
Type		
Capacity (approx.)	tons	
Motor size	kW (hp)	
Refrigerated Stores Condenser		
Manufacturer		
Number installed		
Type		
Refrigerated Stores Receiver		
Manufacturer		
Number installed		
Type		
Pump-down capacity (approx.)	%	

COMPRESSED AIR SYSTEM

Air Starting Compressors		**Remarks:**
Manufacturer		
Number installed		
Type		
Free air		
Discharge pressure	m^3/hr (cfm)	
Motor size	kPa (psi)	
Start limit	kW (hp)	
Stop limit	kPa (psi)	
Control	kPa (psi)	
Air Start Receivers		
Manufacturer		
Number installed		
Type		
Capacity	m^3 (ft^3)	
Design pressure	kPa (psig)	
Ship's Service Air Receiver		
Number installed		
Type		
Capacity	m^3 (ft^3)	
Design pressure	kPa (psig)	
Control Air Receiver		
Number installed		
Type		
Capacity	m^3 (ft^3)	
Design pressure	kPa (psig)	
Control Air Dehydrator		
Manufacturer		
Number installed		
Type	m^3 (ft^3)	
Discharge air temp.	°C (°F)	
Capacity	m^3 hr (scfm)	

MACHINERY SPACE VENTILATION

Supply Fans		**Remarks:**
Manufacturer		
Number installed		
Type		
Capacity	m^3/hr (cfm)	
Static Head, H_2O	mm (inches)	
Motor size	kW (hp)	
Speed	rpm	

Exhaust Fans		
Manufacturer		
Number installed		
Type		
Capacity	m^3/hr (cfm)	
Static Head, H_2O	mm (inches)	
Motor size	kW (hp)	
Speed	rpm	

HULL MACHINERY

Steering Gear		**Remarks:**
Manufacturer		
Number installed		
Type		
Motor size	kW (hp)	

Mooring Winch and Windlass		
Manufacturer		
Number installed		
Type		
Motor size	kW (hp)	

Constant Tension Mooring Winches		
Manufacturer		
Number installed		
Type		
Motor size	kW (hp)	

Bow Thruster		
Manufacturer		
Number installed		
Type		
Output rating	kW (hp)	

Stern Thruster		
Manufacturer		
Number installed		
Type		
Output rating	kW (hp)	

ELECTRICAL SYSTEM

Main Engine Driven Generator		**Remarks:**
Manufacturer		
Number installed		
Type		
Volts at 0.8 pf		
Output rating	kW	
Speed	rpm	
Number of phases		
Hertz		

Diesel Generator		
Manufacturer, engine		
Manufacturer, generator		
Number installed		
Type		
Speed	rpm	
Output rating	kW	
Volts at 0.8 pf		
Number of phases		
Hertz		

Emergency Diesel Generator		
Manufacturer, engine		
Manufacturer, generator		
Number installed		
Type		
Speed	rpm	
Output rating	kW	
Volts at 0.8 pf		
Number of phases		
Hertz		

MISCELLANEOUS

Lifting Arrangements		**Remarks:**
Number installed		
Main engine		
Ship service generator (s)		
Emergency generator (s)		
Fuel oil centrifuge (s)		
Diesel oil centrifuge (s)		
Lube oil centrifuge (s)		
Others		

Listing of Alarms

Main Engine	**Sensor Type**	**Voltage**	**Remarks:**

MISCELLANEOUS

Listing of Alarms

Reduction Gear	Sensor Type	Voltage	Remarks:

Listing of Alarms

Others	Sensor Type	Voltage	Remarks:

MISCELLANEOUS

Listing of Gauges

Main Engine	Sensor Type	Voltage	Remarks:

Listing of Gauges

Others	Sensor Type	Voltage	Remarks:

MISCELLANEOUS

Control Locations		**Remarks:**
Number installed		
Type of controls		
Local	Yes/No	
Engine room	Yes/No	
Pilot house	Yes/No	
Bridge wings	Yes/No	
Others	Yes/No	

Miscellaneous		

MISCELLANEOUS

Provide Sketch of existing Main Engine and Reduction gear foundation:
(include dimensions)

MISCELLANEOUS

Provide ideas/sketch for removal of Main Engines and other major equipment from machinery space:

MISCELLANEOUS

Provide any other technical information pertinent to the repower:

MISCELLANEOUS

Required Drawings		**Remarks:**
General Arrangement		
Machinery Arrangement		
Shafting Arrangement		
Ventilation Arrangement		
Exhaust Pipe Arrangement		
Fuel Oil System Diagram		
Diesel Oil System Diagram		
Lube Oil System Diagram		
Compressed Air Sys. Diagram		
Sea Water System Diagram		
Fresh Water System Diagram		
Exhaust System Diagram		
Control Air Diagram		
Steam System Diagram		
Condensate System Diagram		
Electrical One Line Diagram		
Electrical Load Analysis		

Note: If the above noted diagrams are not available, provide sketches of the various systems in way of the main engines: (Use additional pages as required.)