

MIL-C-23233(SHIPS)  
29 May 1962

**MILITARY SPECIFICATION**  
**COUPLINGS FOR PROPULSION UNITS,**  
**AUXILIARY TURBINES AND LINE SHAFTS**  
**NAVAL SHIPBOARD**

**1. SCOPE**

**1.1 Scope.** - This specification covers flexible shaft couplings for propulsion units, auxiliary turbines and line shafts.

**1.2 Classification.** - Couplings shall be of the following types and classes as specified (see 6.1):

Type I - Dental (gear tooth) coupling, lubricated by oil circulation.

Class 1 - 275 Minimum Brinell tooth hardness.

Class 2 - 350 Minimum Brinell tooth hardness.

Class 3 - 477 Minimum Brinell tooth hardness (nitrided).

Class 4 - 601 Minimum Brinell tooth hardness (carburized) or induction hardened).

Type II Dental (gear tooth) coupling, self-contained lubricant.

Type III - Laminated-disc coupling.

Type IV - Noise-attenuation coupling (non-magnetic).

Type V - Line-shaft noise-attenuation coupling.

**2. APPLICABLE DOCUMENTS**

**2.1** The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

**SPECIFICATIONS**

**FEDERAL**

QQ-A-601 - Aluminum Alloy; Sand Castings.

QQ-S-691 - Steel; Plate (Marine Boiler)

QQ-S-766 - Steel Plates, Sheets and Strip; Corrosion-Resisting.

GGG-P-781 - Puller and Puller Kit, Mechanical and Mechanical Puller Attachment.

**MILITARY**

MIL-B-857 - Bolts, Nuts and Studs.

MIL-S-866 - Steel: Bars and Billets (for Carburizing).

MIL-S-890 - Steel: Forgings and Bars for Hulls, Engines and Ordnance (Heat Treated).

MIL-S-901 - Shockproof Equipment, Class HI (High-Impact), Shipboard Application, Tests for.

MIL-A-907 - Antiseize Compound, High Temperature.

MIL-D-963 - Drawings, Electrical, Hull and Mechanical Equipment for Naval Shipboard Use.

MIL-L-2105 - Lubricant, Gear, Universal.

MIL-A-8625 - Anodic-Coatings for Aluminum and Aluminum Alloys.

MIL-Q-9858 - Quality Control System Requirements

MIL-M-15071 - Manuals, Equipment and Systems.

MIL-S-15083 - Steel Castings.

MIL-P-15137 - Provisioning Technical Documentation for Repair Parts for Electrical and Mechanical Equipment (Naval Shipboard Use).

MIL-S-16974 - Steel Bars, Billets, Blooms and Slabs; Carbon and Alloy. (for Reforgings or Other Operations Before Heat Treatment)

MIL-P-17286 - Preservation, Packaging, Packing and Marking of Propulsion and Auxiliary Steam Turbines and Gears (Includes Associated Repair Parts).

MIL-G-17740 - Grease, Extreme Pressure.

MIL-S-22698 - Steel Plate, Carbon, Structural, for Ships.

MIL-N-25027 - Nut, Self-Locking.

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## STANDARDS

## MILITARY

- MIL-STD-10 - Surface Roughness, Waviness and Lay.
- MIL-STD-130 - Identification Marking of U.S. Military Property.
- MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment
- MIL-STD-271 - Non-Destructive Testing Requirements for Metals
- MIL-STD-278 - Welding and Allied Processes for Machinery for Ships of U.S. Navy

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

## 3. REQUIREMENTS

## 3.1 Materials. - Materials shall be as follows:

- (a) As specified in the contract or order.
- (b) Government - specification materials equal to or better than those specified subject to acceptance by the bureau or agency concerned.
- (c) Vendor materials equal to or better than those specified subject to acceptance by the bureau or agency concerned.
- (d) Commercial materials equal to or better than those specified subject to acceptance by the approval activity. Commercial materials are defined as those in accordance with National Society or association requirements. Where materials are not specified they shall be of the quality best suited for the purpose.

3.1.1 Substitute materials. - Substitute materials shall be in accordance with the substitute specifications specifically approved by the bureau or agency concerned.

3.1.2 Substitute material approval. - Vendors who anticipate bidding to this specification may obtain from the bureau or agency concerned "across the board" approval of commercial or vendor-specification materials, including test and examination requirements, to be used in lieu of the government-specification requirements referred to herein. Welding rod shall be in accordance with Military or Federal specifications.

3.1.2.1 When bidding, suppliers who anticipate using substitute materials, shall indicate these materials as alternates in the bid proposal. The material substitutions shall be approved or not

approved in whole or in part by the bureau or agency concerned. Such approval will apply only to a specific purchase or contract.

3.2 Design. - The principle of reliability shall be paramount and no compromise of this principle shall be made with any other basic requirements of the design. It is the intention of this specification to obtain couplings that will operate over a long period of years with a minimum of servicing.

3.2.1 Life. - Insofar as is practicable, couplings shall be designed for life equal to that required for the associated gear or turbine (see 6.1). Where different life is indicated for associated equipment, couplings shall be designed for the greater life requirement.

3.2.2 Design for ship operation and test. - The design shall be satisfactory for the conditions required for the parent equipment or as specified (see 6.1).

3.2.3 Collaboration. - The coupling vendor shall collaborate with the gear and turbine vendor(s), as applicable, to assure that operating and installation requirements are identical and mutually acceptable. Drawings for this purpose shall be provided to the extent required by the turbine and gear vendor(s).

3.3 General requirements. -

3.3.1 Tooth form. - Teeth used for couplings shall be of the involute or modified involute form (except Type III).

Toothed couplings shall be designed so that replacement due to wear is not required until backlash is at least equal to design backlash plus 20 percent of the male tooth design chordal tooth thickness.

3.3.2 Securing to shaft. - Sleeves, hubs, plates and flanges, shall be secured to shafts or distance pieces by fitted bolts or shall be splined, shrunk or keyed, as applicable. Where such parts are splined or shrunk, retaining nuts shall be employed unless otherwise approved by the bureau or agency concerned. Retaining nuts shall be suitably locked against turning. Nuts used on through bolts shall be of the self-locking type.

3.3.3 Bolting for casings. - Bolts and nuts shall be in accordance with MIL-B-857. For non-magnetic applications the material shall be non-magnetic, but shall conform to the dimensions of MIL-B-857.

3.3.3.1 Bolting for rotating parts. - Fitted bolts in accordance with grade 5 of MIL-B-857 and

self-locking nuts in accordance with MIL-N-25027 shall be used to secure flanges. Other bolting required shall be in accordance with grade 5 of MIL-B-857. Non-magnetic bolting shall conform to the dimensions of MIL-B-857.

3.3.4 - Bolt holes When couplings are nitrided or carburized, bolt holes and adjacent area shall not be case-hardened to permit reaming at assembly.

3.3.5 - Blockage of oil For couplings lubricated by oil jets, provision shall be made to prevent blockage of inlet oil and covering of sludge removal holes which could be caused by floating pieces in the extreme forward or after position.

3.3.6 Tooth contact. - Dental couplings shall be checked in an aligned position to assure that at least 80 percent of the teeth are in contact or as specified in the contract or order.

3.3.7 Match marking - For dental coupling elements, meshing position of internal and external teeth shall be clearly and permanently marked for the engagement made at the 80 percent tooth contact check.

3.3.8 Balance - All coupling parts rotating at more than 150 r.p.m. shall be balanced dynamically. The addition of weights to correct for balance after finish machining will not be permitted. Balance shall be accomplished by removal of metal. Drawings submitted for approval to the bureau or agency concerned shall state permissible amount of unbalance in inches. Balancing shall be in accordance with MIL-STD-167. Bolts shall be furnished as sets, or, for line shaft couplings, they may be sized for their respective holes and marked.

3.3.9 Marking - As a minimum requirement, coupling metal shall be marked to indicate contract number, manufacturer, date manufactured and manufacturer's assembly or detail drawing number. Other marking may be added at the discretion of the vendor. Markings shall conform to MIL-STD-130 and shall be applied so as to avoid any significant reduction of fatigue life. Other marking requirements of MIL-STD-130 shall apply.

3.3.10 Welding, brazing and allied processes. - Welding, brazing and allied processes shall conform to MIL-STD-278. Welding rod shall be in accordance with Military and Federal specifications.

3.3.11 Housing (guards). - Housing (guards) shall be split to permit removal. Flange jack bolts shall be provided for parts heavier than 35 pounds.

3.3.11.1 Unless otherwise approved by the bureau or agency concerned, casing, covers and bases shall be constructed of cast steel class B or CW in accordance with MIL-S-15083, or shall be welded

construction incorporating cast steel, class B or CW and steel plate in accordance with class B of QQ-S-691 or type I of MIL-S-22698.

3.3.11.2 For small boat installations, case, cover and base may be constructed of heat-treated aluminum alloy, for which class 3M or 10M of QQ-A-601 shall apply.

3.3.12 Deterioration. - In order to prevent deterioration due to corrosion, all bolts, nuts, studs, pins, springs, screws, cap screws, and other fastenings or fittings used with aluminum alloy shall be of a suitable corrosion-resisting material, or of a material treated in a satisfactory manner to render it adequately resistant to corrosion. Aluminum, where used, shall be anodized in accordance with MIL-A-8625 or protected against corrosion by a suitable process such as Alodine, Alrok, Bonderize, or equal. Contact between dissimilar aluminum alloys or dissimilar metals shall be avoided as much as possible. Where assembly of dissimilar metals with aluminum alloys is unavoidable, the alloys shall have their facing surfaces anodized. Where threaded surfaces or facing surfaces may require disassembly in service, an antiseize compound in accordance with MIL-A-907 shall be used. For the assembly of aluminum alloy parts, through bolting is preferred using cadmium or zinc-plated steel bolts and nuts; this shall be applied with particular emphasis to comparatively high stressed assemblies or those subject to vibrating loads. Where the use of cap screws, stud bolts, or machine screws is necessary aluminum parts shall be threaded into steel inserts cast or screwed into the aluminum alloy. The steel inserts shall be pinned or prick punched in such a manner as to prevent their backing out. All cap screws, stud bolts, and machine screws shall be of steel with cadmium or zinc plating. No alloys of copper such as brass or bronze will be acceptable for use in threaded contact with aluminum alloys.

3.3.13 Shock requirements. - Unless otherwise specified (see 6.1), couplings shall be designed to resist vertical, athwartship and fore-and-aft accelerations in accordance with those stated for associated equipment, or, if these values are not available, in accordance with figure 1. Where specified by the bureau or agency concerned, equipment shall be in accordance with MIL-S-901.

3.3.14 Calculations. - For each application, calculations at the full power condition shall be furnished to the approving activity. Calculations shall be as follows:

- (a) Hertz stress of teeth aligned and misaligned shall be calculated in accordance with the following:

$$SC \text{ (psi)} = 2290 \sqrt{\frac{T}{F.R.C. Ha.N}}$$

T = torque (inch-pounds)

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$r$  = radius of pitch circle (inch)  
 $h_a$  = active tooth height (inch)  
 $c$  = percent of teeth in contact (as a decimal that is 100 percent equals 1.0)  
 $R$  = radius of tooth face crown (1 inch)  
 $N$  = number of hub or distance piece teeth (1 end)

- (b) Shear stress of coupling bolts (ignoring flange friction).
- (c) Stress of distance piece.

3.3.15 Lifting - Provision or arrangements shall be made for lifting parts which weigh more than 35 pounds.

### 3.4 Type I - dental (gear tooth) coupling, lubricated by oil circulation. -

#### 3.4.1 General design. -

3.4.1.1 Unless otherwise specified (see 6.1), type I dental couplings between engine and gear shall be of the double-engagement type.

3.4.1.2 Type I, classes 1 through 4. - Type I, classes 1 through 4 dental couplings shall be made of forged steel as follows:

- (a) Class 1 - Coupling material for parts with involute teeth shall be in accordance with alloy No. 2 of MIL-S-890; tooth meshing surfaces shall have a minimum Brinell hardness of 275.
- (b) Class 2 - Coupling material for parts with involute teeth shall be in accordance with alloy No. 1 of MIL-S-890; tooth meshing surfaces shall have a minimum Brinell hardness of 350.
- (c) Class 3 - Coupling material for parts with involute teeth shall be in accordance with grade 4340 of MIL-S-16974; tooth meshing surfaces shall be nitrided to a minimum Brinell hardness of 477 and a minimum case depth of 0.025 inches.

NOTE: Case depth shall be defined as that depth below the surface at which the hardness of the case and the hardness of the core blend to become one and the same value.

- (d) Class 4 - Coupling material for parts with involute teeth shall be in accordance with MIL-S-866 for carburizing, or medium carbon steel for induction hardening. Tooth meshing surfaces shall be case-hardened to 55 RC minimum and a minimum case depth of 1/10 chordal tooth thickness.

NOTE: Case depth is hardness to RC 50.

3.4.1.3 Flanged connections shall be provided with a rabbet for centering. Flanges shall be counter-bored to shroud bolt heads and nuts, except that shrouding is not required for line shaft coupling bolt heads and nuts.

3.4.1.4 The design shall be such that the dental couplings can be disassembled without removing the connected shafts.

3.4.1.5 Provision shall be made to restrict the fore-and-aft movement of the floating member, to that required for necessary working clearance; where practicable, oil dams shall not be utilized for this purpose.

#### 3.4.2 Lubrication. -

3.4.2.1 Unless otherwise approved by the bureau or agency concerned, type I dental coupling teeth shall be continuously lubricated by means of jets (see 6.1).

3.4.2.2 Oil dams shall be incorporated to keep the coupling teeth totally submerged in oil during operation. Dams attached by fasteners shall be centered on the coupling by a rabbet. Cap screws used to secure the dam to the sleeve shall be of the self-locking type.

3.4.2.3 The coupling shall be designed to permit a flow of oil across the teeth and to reduce the accumulation of sludge to a minimum.

#### 3.4.3 Housing. -

3.4.3.1 Where type I dental coupling teeth are lubricated by jets, the couplings shall be enclosed in oil-tight guards. For type I dental couplings connecting engine or turbine shafts to pinion shafts, the guards shall terminate in flanged connections for bolting to the engine or turbine and gear housings. They shall be split horizontally. The guards shall be provided with a circumferential packed slip joint to permit axial displacement. Provision shall be made for oil drainage.

#### 3.4.4 Tooth design. -

3.4.4.1 Unless specified otherwise by the bureau or agency concerned, type I dental couplings shall be designed with the shorter face teeth crowned, (face barrelled). The taper of the crown shall be from 0.00075 to 0.0015 inch on each face and at each end; internal teeth shall be straight. It is preferred that the internal teeth be longer than the external teeth. The outside diameter of the teeth shall be barrelled designed with a rocker projection.

3.4.4.2 Unless otherwise specified (see 6.1), both internal and external tooth surfaces shall be finished to 32 microinches RHR or better.

3.4.4.3 Corners at ends of the distance piece teeth shall be chamfered or rounded off.

3.4.4.4 Coupling teeth shall be inspected by the magnetic particle method after completion of machining in accordance with MIL-STD-271.

#### 3.4.5 Balance. -

3.4.5.1 Distance pieces with all integral pieces shall be dynamically balanced as a unit. Elements mounted on connected machinery such as sleeve and oil dam shall be dynamically balanced with the attached assembly where possible.

3.4.5.2 Coupling bolts, nuts and cap screws shall be weight balanced to within plus or minus 1.0 gram.

#### 3.4.6 Accuracy - for couplings operating above 2200 rpm. -

3.4.6.1 Rabbets shall be machined to a 0.001 inch or less fit with the mating part.

3.4.6.2 The root diameter of coupling sleeve teeth shall be concentric with the rabbit diameter to within 0.001 inch.

3.4.6.3 In the case of coupling hubs secured to connected shafts, the outside diameter of the hub teeth shall be concentric with the bore diameter to 0.001 inch maximum.

#### 3.5 Type II - dental (gear tooth) coupling self-contained lubricant. -

##### 3.5.1 General design. -

3.5.1.1 Unless otherwise specified (see 6.1), type II couplings shall be of the double-engagement type.

3.5.1.2 Unless otherwise specified (see 6.1) type II coupling material shall be forged steel and shall be 160 Brinell minimum hardness.

3.5.1.3 Bolts and nuts shall be shrouded.

3.5.1.4 Provision shall be made to restrict fore-and-aft movement of the floating member.

3.5.2 Seals. - Spare oil or grease seals shall be of the split type if disassembly or removal of connected machinery would be required for replacement of one-piece seals. Rubber portion of seals shall not serve as bumpers or limit axial float.

3.5.3 Lubrication. - Lubricant shall be oil or grease. The lubricant required shall be specified by navy symbol number. The use of proprietary

lubricant will not be approved. Grease, when specified, in the contract or order shall conform to MIL-G-17740; oil, when specified in the contract or order, shall conform to MIL-L-2105.

3.5.4 Accuracy. - Rabbet fit shall be provided for centering of flanges. Fit required shall be based on permissible unbalance.

3.5.5 Assembly. - When specified (see 6.1), tooth contact checking may be omitted.

#### 3.6 Type III - laminated-disc coupling. -

3.6.1 Discs. - The type III laminated-disc coupling shall consist of a stack of corrosion-resisting steel discs mounted between flanges and secured thereto by means of fitted bolts.

3.6.2 Engagement. - Type III laminated - disc couplings shall be arranged for single or double engagement as required by the bureau or agency concerned (see 6.1). For double engagement couplings, the forward and after discs shall be connected by a forged center ring or distance piece.

3.6.3 Securing. - Discs shall be secured to flanges mounted on driving and driven shafts by fitted bolts. Nuts used on coupling bolts shall be a self-locking type in accordance with MIL-N-25027.

3.6.4 Disc material. - Unless otherwise approved by the bureau or agency concerned, coupling discs shall be corrosion-resisting steel conforming to QQ-S-766.

3.6.5 Flanges. - Flanges shall be forged steel in accordance with class B of MIL-S-890.

3.6.6 Center rings and distance pieces. - Center rings and distance pieces shall be forged steel conforming to alloy No. 2 of MIL-S-890.

3.6.7 Washers. - Spacing washers which are subject to wear shall be forged steel, alloy No. 4, of MIL-S-890. Other washers shall be in accordance with class C of MIL-S-890.

#### 3.7 Type IV - noise-attenuation coupling (non-magnetic)

##### 3.7.1 General design

3.7.1.1 The type IV noise-attenuation coupling shall consist of either, or a combination of, high misalignment dental coupling elements and elastomer torque-transmitting elements for use in a noise-isolated propulsion auxiliary system.

3.7.1.2 The magnetic permeability of the assembled unit shall not exceed 2.0. All portions of



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the coupling assembly shall be of non-magnetic material which shall be as proposed by the contractor and approved by the bureau or agency concerned. However, consideration will be given to the use of magnetic material for improving the wear resistance of critical components of the coupling. The projected outline of such magnetic material should be made as small as possible. The magnetic permeability of the first of-a-design of coupling assembly shall be measured and reported to the bureau or agency concerned (see 6.3).

3.7.1.3 Couplings shall be designed to permit removal and disassembly without disturbing the connected shafting.

3.7.1.4 Couplings shall be capable of transmitting 200 percent of rated torque at the maximum specified misalignment (see 6.1) for a period of one minute for each such application.

3.7.2 Bolting - Bolts and nuts used on high-speed couplings shall be shrouded.

3.7.3 Accuracy. - Accuracy shall be in accordance with 3.5.4.

3.7.4 Lubrication. - Unless otherwise approved by the bureau or agency concerned, couplings shall be designed for self-contained oil or grease lubrication and shall be provided with adequate seals and retainers to prevent leakage over extended periods of operation. Lubricant shall be specified by Navy symbol number or in accordance with government specification. Where oil or grease seals are used, spares shall be of the split type if disassembly or removal of connected machinery would be required for replacement of one-piece seals.

3.7.5 Static. - The first of each coupling design shall be statically tested at 200 percent rated torque (see 4.2.7).

### 3.7.6 Elastomer elements. -

3.7.6.1 Elastomer elements shall be arranged to prevent any direct metal to metal noise path between input and outside ends. The elastomer shall be located to provide removal of generated heat by normal air circulation.

3.7.6.2 Elastomer elements shall not be affected by direct and prolonged contact with mineral oil and grease.

3.7.6.3 Elastomer elements may be arranged for normal loading in either compression or shear. The elements shall not allow appreciable sag of the supported coupling portions which would cause dynamic unbalance. Provision shall be made for positive mechanical drive in the event of failure of the elastomer elements or excessive torque overload.

### 3.7.7 Dental coupling elements. -

3.7.7.1 Unless otherwise specified (see 6.1), dental couplings shall be of the double-engagement type.

3.7.7.2 Notes in 3.4.1.2 for class 3 and class 4 apply respectively to nitrided and carburized (or for induction-hardened) materials.

3.7.7.3 Flanged connections or straight or tapered bored hubs shall be provided for connection for driving and driven machinery.

3.7.7.4 Provision shall be made to restrict fore-and-aft movement of the floating member.

3.7.7.5 Unless otherwise specified (see 6.1), teeth shall be finished to 32 microinches RHR or better.

3.7.7.6 Corners at ends of the distance piece teeth shall be chamfered or rounded off.

3.7.7.7 After completion of manufacture, teeth shall be inspected by the magnetic-particle or liquid-penetrant method, as applicable, in accordance with MIL-STD-271.

3.7.7.8 Hub teeth shall be suitably crowned on the outside diameter and face barrelled to allow the maximum misalignment specified (see 6.1).

3.7.7.9 Mechanical constraints which would cause cocking of the face-barrelled element tending to displace contact from the center of the barrelled face shall be avoided.

### 3.8 Type V line-shaft noise - attenuation coupling. -

#### 3.8.1 General design. -

3.8.1.1 The coupling shall be a double-ended dental type coupling incorporating an elastomer, in compression or shear, for noise isolation.

3.8.1.2 Material and case depth (when case-hardened material is used) shall be as proposed by the contractor and approved by the bureau or agency concerned. Minimum hardness shall be 50 Rc.

3.8.1.3 Provision shall be made to restrict the fore-and-aft movement of the floating member. The amount of axial movement permissible shall be as specified in the contract or order or as required by the misalignment between mounted and solidly-chocked equipment.

3.8.1.4 Where possible, the coupling shall be designed to permit removal without disturbing connecting shafting.

**3.8.2 Lubrication. -**

**3.8.2.1** Lubrication shall be in accordance with 3.4.2.

**3.8.3 Housing. -**

**3.8.3.1** Housing shall be in accordance with 3.4.3, except that the slip joint required by 3.4.3.1 may be omitted if other provision to permit axial expansion is used. The guard shall connect between the mounted equipment and nearest after solidly-chocked member in lieu of turbine-to-gear as stated in 3.4.3.1.

**3.8.3.2** Connection of the housing to the solidly-chocked member shall be designed to avoid a sound short.

**3.8.4 Tooth design. -**

**3.8.4.1** The external teeth shall be crowned on the outside diameter and face barrelled to permit the misalignment or offsets specified (see 6.1). The internal teeth shall be straight.

**3.8.4.2** Unless otherwise specified (see 6.1), tooth contacting surfaces shall be 32 micro-inches RHR or better.

**3.8.4.3** Corners of distance piece teeth shall be chamfered or rounded off.

**3.8.4.4** After completion of manufacture, coupling teeth shall be inspected by the magnetic-particle method, in accordance with MIL-STD-271.

**3.8.4.5** Accuracy requirements shall be as proposed by the manufacturer and as accepted by the approving activity.

**3.8.5 Noise-attenuation element -**

**3.8.5.1** Noise attenuation shall be achieved by elastomer material arranged to prevent any direct metal-to-metal path between input and output ends. The elastomer elements shall be located to provide removal of heat by normal air circulation. The elastomer elements shall be designed to withstand angular and parallel misalignment.

**3.8.5.2** The elastomer elements shall be capable of withstanding contact with mineral oil without deterioration.

**3.8.5.3** The elements may be arranged for normal loading in either compression or shear. The elements shall not allow appreciable sag of the supported coupling portions which would cause dynamic unbalance. Provision shall be made for positive mechanical drive in the event of failure of the elastomer elements or excessive torque overload.

**3.8.6 Solid chocking. -** Provision shall be made in the design of the coupling to permit operation with a solid connection to the mounted equipment (solidly chocked) in lieu of connection through the noise-attenuating and dental elements.

**3.8.7 Balancing. -** Balancing shall be the best obtainable using manufacturer's facilities. Unbalance shall not be greater than shown on approved drawings.

**3.8.8 Maximum torque. -** Couplings shall be capable of transmitting 125 percent of rated torque at the maximum specified misalignment for a period of 5 minutes for each such application.

**3.9 Repair parts and stock components. -**

**3.9.1 Categories. -** Repair parts are of two general categories; namely, onboard repair parts (see 3.9.2) and stock repair parts (including bureau or agency special material), (see 3.9.3 and 3.9.4).

**3.9.2 Onboard repair parts. -** Onboard repair parts shall be those parts which are required to be carried onboard Naval ships for routine maintenance of parent equipment by shipboard personnel. These parts are listed in the ship's onboard allowance. Onboard repair parts shall be furnished and concurrently produced with the couplings specified herein.

**3.9.3 Stock repair parts. -** The procedure for determining the parts and the quantities to be purchased as stock repair parts shall be as required in MIL-P-15137.

**3.9.4 Bureau or agency special material. -** Bureau or agency special material are those bureau or agency special material parts, subassemblies and assemblies which are required to be furnished and concurrently produced with the couplings specified herein. The bureau or agency concerned is the inventory control point.

**3.9.5 Special material with gear. -** Where couplings are furnished as part of a propulsion gear assembly, the bureau or agency special material shall be furnished with the gear.

**3.9.6 List of onboard repair parts. -** Onboard repair parts for couplings shall be furnished by the contractor, to be carried on each ship, as shown in table I.

**3.9.7 List of special material. -** Table II provides guidance for bureau or agency special material for propulsion machinery and line-shaft couplings (see 6.1). Bureau or agency special material is not required for turbo-generators or auxiliary turbines.

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Table I - List of onboard repair parts

Onboard repair parts required	Quantity to be furnished
Oil seals	100 percent for each ship
Snap rings	100 percent for one coupling of each size $\frac{1}{2}$
"O" rings	100 percent for each ship.
Tab or lock washers	100 percent for each ship.
Insert involute tooth elements	100 percent for each ship for type IV

$\frac{1}{2}$ / Multiply quantity by 2 when applicable to double-ended quill shaft coupling.

Table II - Bureau or agency special material for propulsion machinery and line shaft couplings

	Quantity furnished for special material is shafts worth and is based on the number of propulsion shafts installed (see note 1)					
Item	1-2 shafts installed	3-11 shafts installed	12-17 shafts installed	18-23 shafts installed	24-29 shafts installed	Above 49 shafts installed
Type I, propulsion engine coupling	1	2	3	4	5	6
Type II, propulsion engine coupling	1	2	3	4	5	(see note 2)
Type III, propulsion engine coupling	1	1	1	1	1	6
Type IV, Propulsion engine coupling	1	2	3	4	5	1
						6
						(see note 2)
Item	10 shafts installed	Above 10 shafts installed				
Type I, propulsion gear quill shaft coupling	1	2				
Type III, propulsion gear quill shaft coupling	1	1				
Item	1-3 shafts installed	4-6 shafts installed	7-10 shafts installed	11-16 shafts installed	Above 16 shafts installed	
Type V, coupling	1	2	3	4	5	

- NOTES:
- Quantities required are shaft's worth; for example, single shaft, HP and LP turbines, quantity means 1 HP and 1 LP coupling.
  - The minimum quantity furnished shall be sufficient for 100 percent replacement on one ship.

3.9.8 Additional wearing or operating parts. - To the onboard repair parts and bureau or agency special material shall be added any wearing or operating parts or special gear or attachments that the bureau or agency concerned considers necessary for dependable and efficient service maintenance.

3.9.9 Interchangeability of repair parts. - The manufacturer shall advise the bureau or agency concerned in detail as to the interchangeability of repair parts and for couplings furnished herein and those previously furnished or being concurrently furnished under other procurements. This information shall be required prior to determination and assignment of standard Navy stock numbers to those parts.



### 3.10 Special tools and equipment. -

3.10.1 Special tools and equipment. - Special tools and equipment required for overhaul and maintenance shall be supplied and shall be carried onboard. Standard hardware items shall not be furnished.

3.10.2 Pulling tools. - Special pulling tools shall be provided where the standard pullers shown in GGG-P-781 cannot be used.

3.10.3 Other special gear. - Any other special gear or attachments that the bureau or agency concerned considers necessary for the proper maintenance of machinery in service shall be furnished.

### 3.11 Drawings. -

3.11.1 Basic requirements. - Drawings shall be in accordance with MIL-D-963 and as modified herein.

3.11.2 Cross-section drawing. - The cross section drawing shall show the following:

- (a) Overall dimensions and information required for installation.
- (b) Float.
- (c) Design and maximum backlash permissible before replacement is required.
- (d) Position of jets (if not shown by other drawings).
- (e) Oil flow (if not shown by other drawings).
- (f) Navy symbol number for the lubricant (for type II coupling).
- (g) Ballooned items and list of material.
- (h) Match marking.
- (i) Detail drawings may be incorporated with cross-sectional drawing at the option of the vendor.

3.11.3 Extent of drawing detail. - Drawings of parts shall be sufficiently detailed to permit manufacture by a Naval shipyard. Where materials cannot be identified by reference to specifications or approved drawings, physicals and chemicals of the material shall be shown. Surface finish shall be designated in accordance with MIL-STD-10.

3.11.4 Preliminary drawings. - Preliminary drawings which indicate the design and principal materials shall be approved by the bureau or agency concerned.

3.11.5 Microfilm. - Microfilm shall be furnished in lieu of final tracings when more than 30 drawings are required or when microfilm is specifically required (see 6.1). Where couplings are a part of other equipment, the coupling microfilm or drawings shall be furnished with the parent equipment microfilm or drawings. Microfilm shall be as required by MIL-D-963.

3.11.6 List of repair parts. - A drawing list of onboard and bureau or agency special material shall be furnished with the associated gear or turbine list or at the discretion of the vendor, a separate list may be furnished.

3.12 Machinery errors. - Machining errors shall be classified as "major" or "minor" as follows:

- (a) Major machining errors are those which effect operations, safety of equipment, personnel and interchangeability.
- (b) Minor variations are those which are not stated in (a).

3.12.1 Approval of machining error drawings. - Approval of machining error drawings shall be as follows:

- (a) Major. - Approved by drawing approval activity.
- (b) Minor. - Approved by manufacturers inspection force.

3.12.2 Machining error drawing. - Machinery error drawing shall be furnished for each class of ships for major machining errors. Only the portion in error need be shown with reference to applicable drawing. Application of the error to specific unit and ship shall be shown.

3.13 Manuals. - Manuals shall conform to MIL-M-15071. Unless otherwise specified (see 6.1), coupling instructions shall be incorporated with the gear, turbine or other associated equipment manual. Manual content and type shall be the same as that for the associated equipment. The manual, in addition to other requirements, shall include a description and illustration covering a suitable method of checking alignment between coupling and connected machinery. The maximum allowable error for angular and parallel alignment shall be stated.

3.14 Workmanship. - Unless otherwise specified in the contract or order, the Government inspector having jurisdiction at the manufacturer's plant shall be the judge of whether or not work is satisfactory and acceptable to the bureau or agency concerned, except for areas specifically designated to the bureau or agency concerned.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.1.1 The quality control system requirements shall be in accordance with MIL-Q-9858.

#### 4.2 Quality conformance inspection. -

4.2.1 Material testing. - Material testing shall be as approved by the bureau or agency concerned. Where material is approved (see 3.1) without reference to material testing, the testing requirements of the material specification shall apply.

4.2.1.1 Substitute material examination and testing. - Substitute materials shall be examined and tested as required by the substitute specifications specifically approved by the bureau or agency concerned (see 3.1.1). The Government inspector need not be present when the examination and tests are made, but the vendor shall fully document the results. When requested, the vendor shall furnish the test results to the Government inspector.

4.2.1.2 Material tests for steel forgings. - Unless otherwise specified in the contract or order, tensile strength, yield point, elongation, reduction of area and bend tests are not required for types I, II and III coupling forgings.

4.2.1.3 Ultrasonic tests for solid shafts. - Solid shafts shall be ultrasonic tested in accordance with MIL-STD-271.

4.2.2 Tooth contact check. - Unless otherwise specified in the contract or order, all dental-type couplings (types I, IV and V) shall be checked for tooth contact to determine conformance to the requirements specified herein.

4.2.3 Match marking. - For dental coupling elements (types I, II, IV and V) meshing position of internal and external teeth shall be checked to determine conformance with the requirements specified in 3.3.7.

4.2.4 Welding, brazing and allied processes. - Examination and test procedures for welding, brazing and allied processes shall be conducted to determine conformance with the requirements specified in 3.3.10.

4.2.5 Magnetic particle or liquid penetrant and residual magnetism. - Where so required, all gear teeth of couplings and all shafts shall be subjected to inspection by the magnetic particle or liquid penetrant method. Residual magnetism of magnetic parts measured after completion of all machining shall not exceed 3 gauss.

4.2.6 Dynamic tests. - Couplings shall be tested with the reduction gear, engine or turbine with which used to the same extent as is required for the parent equipment or as specified in the contract or order.

4.2.6.1 During the dynamic tests, a check shall be made of the couplings for the following:

- (a) Quiet running.
- (b) Freedom from vibration.
- (c) Wearing of parts.
- (d) Tightness of casing and piping connections.
- (e) Adequacy of oil seals.

Any unsatisfactory conditions or evidence of probable unsatisfactory operation in service apparent on the dynamic tests shall be considered cause for rejection of the coupling.

4.2.7 Static tests (type IV only). - The first of each type IV coupling design shall be statically tested to determine conformance with 3.7.5.

#### 5. PREPARATION FOR DELIVERY

5.1 Painting, preservation, packaging, packing and marking. - Couplings, stock components and repair parts shall be painted, preserved, packaged, packed and marked for the level of shipment specified (see 6.1) in accordance with MIL-P-17286.

#### 6. NOTES

6.1 Ordering data. - Procurement documents shall specify the following to indicate requirements. Where an item is omitted in the procurement document, either the subparagraph is not applicable or modification to this specification is not required.

- (a) Title, number and date of this specification.
- (b) Type and class required (see 1.2).
- (c) Life (see 3.2.1).
- (d) Design for ship operation and test (see 3.2.2 and 4.2.6).
- (e) Indicate if shock requirements do not apply; and indicate if MIL-S-901 applies (see 3.3.13).
- (f) Indicate whether other than double engagement type is required (see 3.4.1.1, 3.5.1.1, 3.6.2 and 3.7.7.1).
- (g) Whether force feed lubrication is not required for type I (see 3.4.2.1).
- (h) Indicate if tooth finish is greater than 32 microinch RHR (see 3.4.4.2, 3.7.7.5 and 3.8.4.2).
- (i) Indicate if hardness greater than 160 BHN is required for type II (see 3.5.1.2).
- (j) Indicate if tooth contact check may be omitted for type II (see 3.5.5).
- (k) Misalignments or offsets and axial float (see 3.7.1.4, 3.7.7.8 and 3.8.4.1).
- (l) Quantity of bureau or agency special material (see 3.9.7 and table II).
- (m) Microfilm requirements (see 3.11.5).
- (n) Manual requirements (see 3.13).
- (o) Level of shipment required (see 5.1).

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**6.2 Bid proposal data.** - The following shall be furnished with each bid proposal for a new design:

- (a) Principal materials and substitute materials (see 3.1, 3.1.1, 3.1.2 and 3.1.2.1).
- (b) Calculations (see 3.3.14).
- (c) Drawing which indicates arrangement and dimensions.
- (d) Coupling tooth geometry (except type III).
- (e) Total weight for type V only.
- (f) Shear or compression (psi) for elastomer (types IV and V only).

**6.3 Reports.** - After completion of the first coupling assembly the following reports are to be submitted:

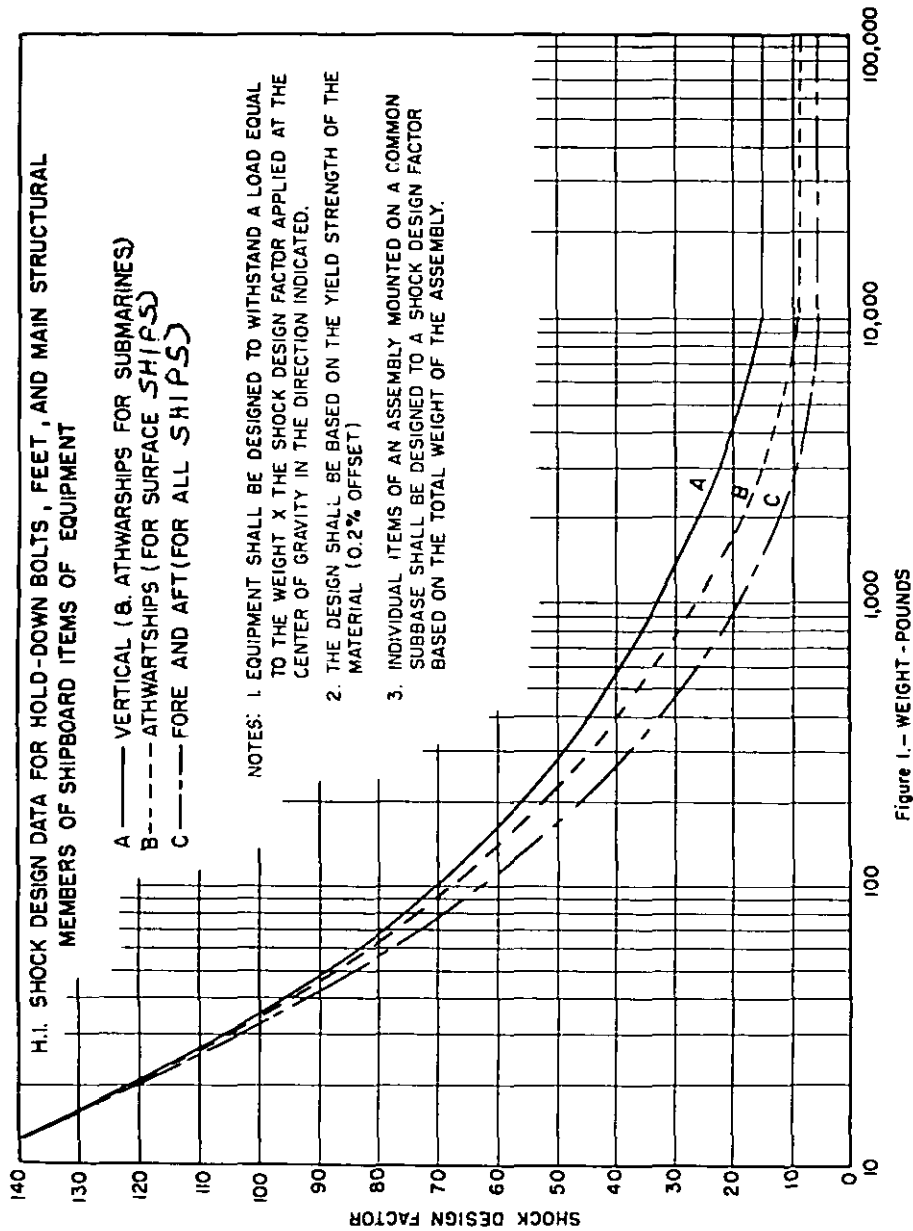
- (a) Magnetic permeability for type IV (see 3.7.1.2).

- (b) For new designs which are not part of a gear or turbine, type V. Quarterly confirmation report of weight and location of center of gravity. Any change of weight exceeding 2 percent of the total weight shall be reported immediately.

**Notice.** - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Preparing activity:  
Navy - Ships  
(Project 2010-N023 Sh)

MIL-C-23233 (SHIPS)



**SPECIFICATION ANALYSIS SHEET**  
**NAVSHIPS-4863 (8-61)**
**INSTRUCTIONS**
**BUDGET BU. NO. 45-R309**

*This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Bureau of Ships*

*This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured*

*with a minimum amount of delay and at the least cost.*

*Comments and the return of this form will be appreciated.*

*Fold on dotted lines on reverse side, staple in corner, and send to Bureau of Ships, Specifications and Standardization Branch, Washington 25, D.C.*

**SPECIFICATION**
**ORGANIZATION**
**CITY**
**STATE**
**CONTRACT NO.**
**QUANTITY OF ITEMS REQUIRED**
**DOLLAR AMOUNT**
**\$**
**MATERIAL PROCURED UNDER A DIRECT GOVERNMENT CONTRACT**
☐
**OR A SUBCONTRACT**
☐

**1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?**  
**a. GIVE PARAGRAPH NUMBER AND WORDING**

**b. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.**

**2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID.**

**3. IS THE SPECIFICATION RESTRICTIVE?**

☐
**YES**
☐
**NO**

**IF THE ANSWER IS "YES", IN WHAT WAY?**

**4. REMARKS (Attach any pertinent data which may be of use in improving this specification.) PLACE THIS FORM AND PAPERS IN AN ENVELOPE AND SEND TO THE BUREAU.**

**SUBMITTED BY (Print name and activity)**

**DATE**