

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 240

**Special Purpose Couplings for Petroleum, Chemical
and Gas Industry Services according to
API Standard 671**

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1. Scope

This specification clarifies how to use the recommendations of [API STD 671](#) for the supply to Company of couplings for the transmission of power between the rotating shafts of two machines in special purpose applications in the petroleum, petrochemical, and natural gas industries.

The purpose of this specification is to clarify the requirements of [API STD 671](#) standard fourth edition, August 2007.

This document modifies or complements some requirements of [API STD 671](#) standard, when deemed necessary considering Company experience.

The paragraph numbering is defined in the same way as in [API STD 671](#) except for additional requirements, which may be presented with new paragraph numbers. The summary sheet at front indicates where to find the information for each paragraph of [API STD 671](#) shown with a bullet.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
ANSI/AGMA 9003-B	Flexible Couplings - Keyless Fits
API STD 671	Special Purpose Couplings for Petroleum, Chemical and Gas Industry Services
DIN 7190 (All parts)	Interference fits - All parts

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
Not applicable	

3. Comments to API STD 671

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3 Terms and definitions	
For the purposes of this document, the following terms and definitions apply.	The terms and concepts defined in section 3 of API STD 671 shall be used, with the following amendments.
3.1 Purchaser Agency that issues the order and the specification to the Vendor. Note: The purchaser can be owner of the plant in which the equipment is to be installed the owner's appointed agent or, frequently, the manufacturer of the driven machine.	Vendor is the coupling supplier. Purchaser is the supplier of the driven or driver machine having the complete responsibility of the shaft line. Company refers to TOTAL, its subsidiaries, agents or associates.
4 Statutory requirements	
The purchaser and the vendor shall mutually determine the measures to be taken to comply with any federal, state or local codes, regulations, ordinances or rules that are applicable to the equipment.	Codes and regulations that shall apply are listed in the Project Specification, including ATEX rules requirements.
5 Coupling selection	
5.1 The purchaser shall specify the type of coupling required. Unless otherwise specified, the coupling shall be a metallic flexible-element coupling. For torsional damping and resilient couplings, refer to Annex A; for gear couplings, refer to Annex B; and for quill-shaft couplings, refer to Annex C.	Couplings shall be metallic flexible-element type. Either metallic disc type or metallic diaphragm type are acceptable to Company. Any other coupling type, such as torsional damping couplings, shall be subject to a formal derogation by Company. Resilient couplings and gear couplings shall not be used. Quill-shaft couplings can only be used between gearbox and generator. If quill-shaft coupling is used, the Purchaser shall provide a lateral analysis for the rigid part of the shaft line.
5.3 If specified, the coupling, coupling-to-shaft juncture and shafting may be sized for a future condition.	Refer to Project Data Sheets and Specification.

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6 Coupling design	
• 6.1 The purchaser shall specify the following requirements, where applicable: a) type of train; b) normal power; c) normal speed and variations; d) maximum continuous speed; e) any defined overspeed; f) angular misalignment; g) axial displacements; h) shaft sizes and styles; i) distance between shaft-ends; j) temperature; k) type of driver; l) driver power rating (list and driver service factor); m) expected transient (peak) and cyclic torque conditions, including magnitude, nature and number of occurrences of transients to which the coupling will be subjected in service.	This paragraph is applicable.
• 6.2 The purchaser shall specify the maximum angular misalignments the coupling is expected to experience during start-up, normal operation and shut-down of the coupled machines, normally expressed as parallel (or lateral) offset and/or angular misalignment between the coupled shafts. These values shall allow for all the known effects on the machines from thermal, pressure and dynamic forces. Unless otherwise specified, the steady-state angular misalignment capability across each flexible element shall be not less than 0.2°.	This paragraph is fully applicable. In addition, the steady-state angular misalignment capability across each flexible element shall be not less than 0.2°.
• 6.3 The purchaser shall specify the maximum axial displacements the coupling is expected to experience, expressed as the amount and direction of the relative movement of the shaft ends toward or away from each other as the coupled machines go through their start-up, normal operation and shut-down	This paragraph is not applicable to quill-shaft couplings. For all other acceptable coupling designs, this paragraph is fully applicable. In addition, the minimum steady-state axial deflection (plus/minus) capability shall be

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cycle. These dimensions shall be given from the machine at ambient conditions, non-operating position. Unless otherwise specified, the minimum steady-state axial deflection (plus/minus) capability shall be determined by the largest shaft diameter divided by 125.	determined by the largest shaft diameter divided by 75.
6.4 The purchaser shall specify the speed range for the fully assembled coupling, moment simulator and solo plate for both continuous speed and any defined overspeed.	This paragraph is applicable.
6.5 The steady-state torque, T_n, expressed in newton-metres (inch-pounds force), shall be determined as given in Equation (1): $T_n = \frac{K_1 \times P_{\text{normal}}}{N_{\text{normal}}} \quad (1)$ Where: - K1 is a constant, equal to 9,550 (63,000); P_{normal} is the input power required by the driven machine at the specified normal operating point, expressed in kilowatts (horsepower); N_{normal} is the speed corresponding to the normal power, expressed in revolutions per minute. - If specified by the purchaser, the steady-state torque shall be based on the power required by the driven machine at the rated operating point and the corresponding speed rather than that at the normal operating point. This can be appropriate if the power required by the driven machine at the rated point is significantly higher than that at the normal point. Note 1: This situation can occur, for example, in the case of a centrifugal compressor with a number of different specified operating duties. Note 2: Basing the coupling torque rating on the driven-machine-rated operating point rather than the normal point can result in a coupling that is undesirably large or heavy. This can be significant if one or both of the connected machines is sensitive to overhung mass. The purchaser should also consider possible	Refer to paragraph 6.9.

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future up-rating of the connected machines, for example augmentation of the power output of a gas turbine by water injection.	
6.6 Unless otherwise specified, the steady-state selection torque, T_s, expressed in newton-metres (inchpounds), used to select the coupling shall be as given in Equation (2): $T_s = T_n \times F_s \quad (2)$ Where: F_s is the service factor (as specified for the specific coupling type). Note: The service factor allows for various modes of off-design operation that can result from such factors as a change in density of the fluid (molar mass, temperature or pressure variation), unequal load sharing, fouling or driver output at maximum conditions.	Refer to paragraph 6.9.
6.7 Unless otherwise specified, the coupling shall have, as a minimum, a service factor of 1.5 for a metallic flexible-element coupling.	Refer to paragraph 6.9.
6.8 The service factor may be reduced by agreement between the purchaser and the vendor if - The characteristics of the driver and driven machines and the operating process are well understood, or - All reasonable attempts to achieve the specified steady-state torque service factor fail to result in a coupling mass and subsequent overhung moment commensurate with the requirement for rotor dynamics of the connected machines. In no case shall the service factor be reduced to a value lower than 1.2 based on the normal power.	Refer to paragraph 6.9.
• 6.9 If specified, for the steady-state conditions, the coupling shall be sized based on the driver rating multiplied by 1.2 (typically, excluding the driver service factor). Note: If the driver rating is large compared with the normal load, this requirement can result in an excessively conservative coupling selection.	This paragraph is applicable. For the steady-state conditions, the coupling shall be sized based on the driver maximum available power at site conditions multiplied by 1.2. In particular, when the driver is a gas turbine, the driver maximum available power shall

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	correspond to the most favorable ambient conditions (e.g. minimum ambient temperature). If more than one coupling is present in the shaft line, the couplings shall be sized based on the driver maximum available power at site conditions multiplied by 1.2, and prorated between the driven equipment on the basis of the power demand of each driven equipment.
● 6.12 If specified, the coupling shall be capable of transmitting a specified transient torque associated with a generator short circuit and/or a motor breaker re-closure without damage. Note: During these situations large torques can occur, which require that the total system be subsequently examined for possible damage.	This paragraph is applicable.
6.13 Unless otherwise specified, the coupling-to-shaft juncture and the machinery shafting shall be capable of operating at a steady-state torque determined in accordance with 6.6, substituting a service factor of 1.75.	The coupling-to-shaft juncture and the machinery shafting shall be capable of operating at a steady-state torque determined in accordance with 6.9, substituting a service factor of 1.75.
6.14 Unless otherwise agreed, the torque capacity of a coupling-to-shaft juncture that is hydraulically fitted and keyless shall be determined by using the methods and equations in ANSI/AGMA 9003 or DIN 7190. Other methods of calculation may be used with the approval of the purchaser. The coefficient of friction used shall be 0.15. The assumed length of hub engagement shall not include "O"-ring and oil-distribution grooves in the hub or the shaft.	This paragraph is fully applicable. In addition, the torque capacity of a coupling-to-shaft juncture that is hydraulically fitted and keyless shall be determined by using the methods and equations in ANSI/AGMA 9003-B or DIN 7190. Use of O-rings is permitted only for shaft end diameter above 240 mm. When O-rings are used, the hub/shaft slip torque capacity defined in ANSI/AGMA 9003-B shall not include the length of O-ring and retention ring (if any) and oil-distribution grooves.
6.15 Couplings may be designed to transmit torque through flange face friction. Unless otherwise agreed, a value of 0.15 shall be assumed for the coefficient of friction. However, the fasteners for coupling flanges, including integral flanges, shall be not less than that required to transmit the specified torques, as identified in 6.9 through 6.12, in	Flanged coupling can be used on gearboxes. Flange connection shall be designed to transmit the specific torque as specified in 6.9 and 6.12 without considering the friction.

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shear.	
7 Coupling ratings	
7.3 For applications where cyclic torques can occur (such as from synchronous motor, generator or reciprocating compressor), the coupling design shall be determined by completing a fatigue analysis. The analysis shall take into account the normal operating conditions in conjunction with the transient conditions (see 6.1). Depending on whether the cyclic loads are considered for a limited number of occurrences or considered to be infinite, either a low-cycle fatigue analysis or high-cycle fatigue analysis shall be performed for the various torque-transmitting components in the coupling. For low-cyclic fatigue analysis, the resultant mean and cyclic stresses plotted on a fatigue diagram shall fall under the applicable life curve (i.e. 10^4, 10^5, 10^6 or 10^7 cycles). The life curve used shall be based on the purchaser specifying the number of occurrences of transients to which the coupling will be subjected in service. For high-cycle fatigue analysis, the analysis and safety factors shall be as specified in 7.1. Transient applications do not require the application of a service factor. In applications where potentially damaging, infrequent, maximum momentary or fault torques occur, the provision of an overload device may be considered to protect the coupling and equipment. Care should be taken that the overload device does not trip prematurely due to low- or high-cycle fatigue of any sacrificial elements. Precautions should also be taken to ensure that the device remains relatively intact after a trip until the connected equipment is brought to a stop.	This paragraph is fully applicable. In addition, overload devices shall not be used, and may be considered for very specific power generation applications only. As a minimum, couplings shall be able to withstand short circuit torques without any overload devices.