TECHNICAL CIRCULAR No. 024 of 15 September 2011

To:	All Surveyors
Applicable to flag:	All Flags
Subject:	Rudder Survey and Rudder Pintle Clearances
Reference:	CLASS-Dry-dock survey

RUDDER SURVEY and RUDDER PINTLE CLEARANCES

A prerequisite for carrying out a Drydocking Survey is adequate staging and removal of the pintle aperture cover plates and rope guard so as to permit access to the upper rudder stock, palm bolts, gudgeons, pintles, top of the stern frame and stern bearing/seal assembly area. These items are of the utmost importance and they cannot be checked from the drydock floor.

The stern frame should be closely examined for fractures and fissures, particularly at the forward end of the skeg connection to plating. Local eroded and corroded areas are often found in the rudder or horn just aft of the propeller blade tips. If not too severe, they may be scaled and filled with epoxy. If the condition appears to be progressing rapidly, waster plates should be fitted over the affected area. The top of the stern frame should also be examined for leakage in way of the core hole closing plates and for any suspicious bulges at the top. Water entering the hollow part of the stern frame, either from the after peak or through a leaking closing plate, may freeze in cold weather causing the frame to fracture or bulge. If water is present it should be drained out and the void space pressure-filled with an inert non-freezing filler. Zinc protection or Swedish iron plates are not required by, but when fitted should be in close metallic contact with the shell and left unpainted. Care should be exercised where these must unavoidably be welded to the stern or rudder castings so as to avoid "welding notch" effects.

The matter of stress relieving stern frames after welding repairs have been affected was considered by our Committees on Materials and Welding. It was pointed out to the Committees that the practice throughout the world differs in stress relieving after completing

large welding repairs which are often necessary at the juncture of the shoe and propeller post. The Committees felt that in general to attempt stress relieving might do more harm than good since the stern frame itself is locked in position in the ship and heating to 1100^{o} to 1200^{o} Fahrenheit might cause stresses of sufficient amount to counteract the beneficial effects of stress relieving. The Committees, however, emphasized the desirability of preheating up to temperatures of 400^{o} Fahrenheit the actual temperature of preheating depending upon whether E6010, E6011, or low hydrogen rods (E7016) are used, the low hydrogen rods not requiring as much preheat as the E6010 and E6011 type.

It is not intended to convey that stress relief of welding repairs to castings is not beneficial if the casting itself can be stress relieved in a furnace, but in the ordinary course of events rarely is a stern frame removed to undertake electric welding repairs.

The rudder and rudder stock should be visually checked for fractures so far as accessible, tightness of the palm bolts (or the covering cement intact), condition of external rudder stops, presence of rudder lift prevention arrangements, weardown of the carrier bearing, condition of securing arrangement and clearance of the gudgeons and pintles. On vessels fitted with clamp-type steadiment (neck) bearings, the clamp bolts should be checked for tightness. Retaining screws or securing arrangements for rudder gudgeon bushings call for close attention.

These frequently work loose and must be wired or heavily punched or staked. A number of rudders have been lost due to pintle nuts backing off allowing the pintle to come out. Pintles installed with the nut and taper upwards are especially susceptible to this problem. Sometimes the pintle simply unscrews out of the nut leaving the nut in place, because the stopper arrangement did not include both nut-to-pintle and nut-to-casting welding. Such welding on large vessels incidentally needs to be relatively heavy to survive the vibration and corrosion until the next drydocking, 6 mm to 8 mm is suggested. For taper-up pintles also, a stopper bar or plate (with a drain hole) welded below the pintle is suggested as additional prevention against pintle (or bushing) dropping out.

Spade-type rudders are especially prone to structural failure if there is excessive clearance in the rudder stock bearing - anything over 4 mm clearance usually calls for remedial action. Rudder carriers are usually oil or grease lubricated metal bearings and maximum clearance of the radial or guide bearing portion should be based on standards for this type bearing, usually in the range of 3 mm to 4 mm.

Regarding bottom painting, it was once common practice to record the vessel's position on the keel blocks and then either "fleet" (short) the vessel so that unexposed keel or bottom plates in way of same, could also be scraped and painted, or relocate it for the same purpose at next drydocking. This is rarely done anymore but points up to a possible corrosion area that may require special attention.

RUDDER PINTLE CLEARANCES

Surveyors shall be in attendance when rudder pintle clearances are taken. Clearance readings should be reviewed and confirmed acceptable for continued service. If the pintle

clearance is found beyond the maximum acceptable criteria, the attending Surveyor is to immediately notify the owner's representative with the renewal requirement.

When pintle clearances are found in the range between the acceptable clearance for continued service to the next scheduled survey (Table 1 – middle column) and the maximum acceptable pintle clearance for renewal (Table 1 - right column), an additional requirement is be created in the survey report due at the next Drydocking Survey instructing the surveyor to confirm the pintle clearance and advising the owner that the pintle clearance is nearing the renewal limit. This additional requirement may be verified during a subsequent UWILD Survey only if a vessel is provided with acceptable means of access, otherwise pintle clearances can only be verified during an out of water Drydocking Survey. The Owner's Representative is to be immediately notified with details of the additional requirement due at the next Drydocking Survey. As a consequence of this action, the owner's representative may take immediate action or schedule the necessary repairs at the next drydocking survey.

All clearances are to be accurately entered in the survey report. Refer to Figure 1 for the correct rudder arrangement nomenclature.

The allowable pintle clearances for conventional-size ships with lignum-vitae or laminated-phenolic-resin gudgeon bushings and for the usual semi-balanced or unbalanced rudder with two or more pintles are noted in table below based on pintle diameter. For single pintle rudders the usual limit is 4.5 mm.

On semi-balanced rudders, the clearance between the pintle and its bearing should be accurately determined, preferably with the aid of a dial indicator, as this is felt to be the critical point. It is difficult to state the acceptable clearance but, for general guidance, and dependent to some extent on the bushing material used, approximately 1% of the pintle diameter to a maximum of 1/4 in. would be acceptable for a further three year service.

TABLE 1

Pintle Diameter (d) "mm"	Range of acceptable Pintle Clearance (pc) "mm" for continued service to next scheduled DD	Max. Acceptable Pintle Clearance (pc) "mm" Immediate renewal limits
d < 300	**3 < Pc < 4.5**	**4.5**
600 > d ≤ 300	**4.5 < Pc < 6.0**	**6.0**
d ≥ 600	**4.5 < Pc < 0.01d**	**0.01d**
Single pintle rudder	**3 < Pc < 4.5**	**4.5**

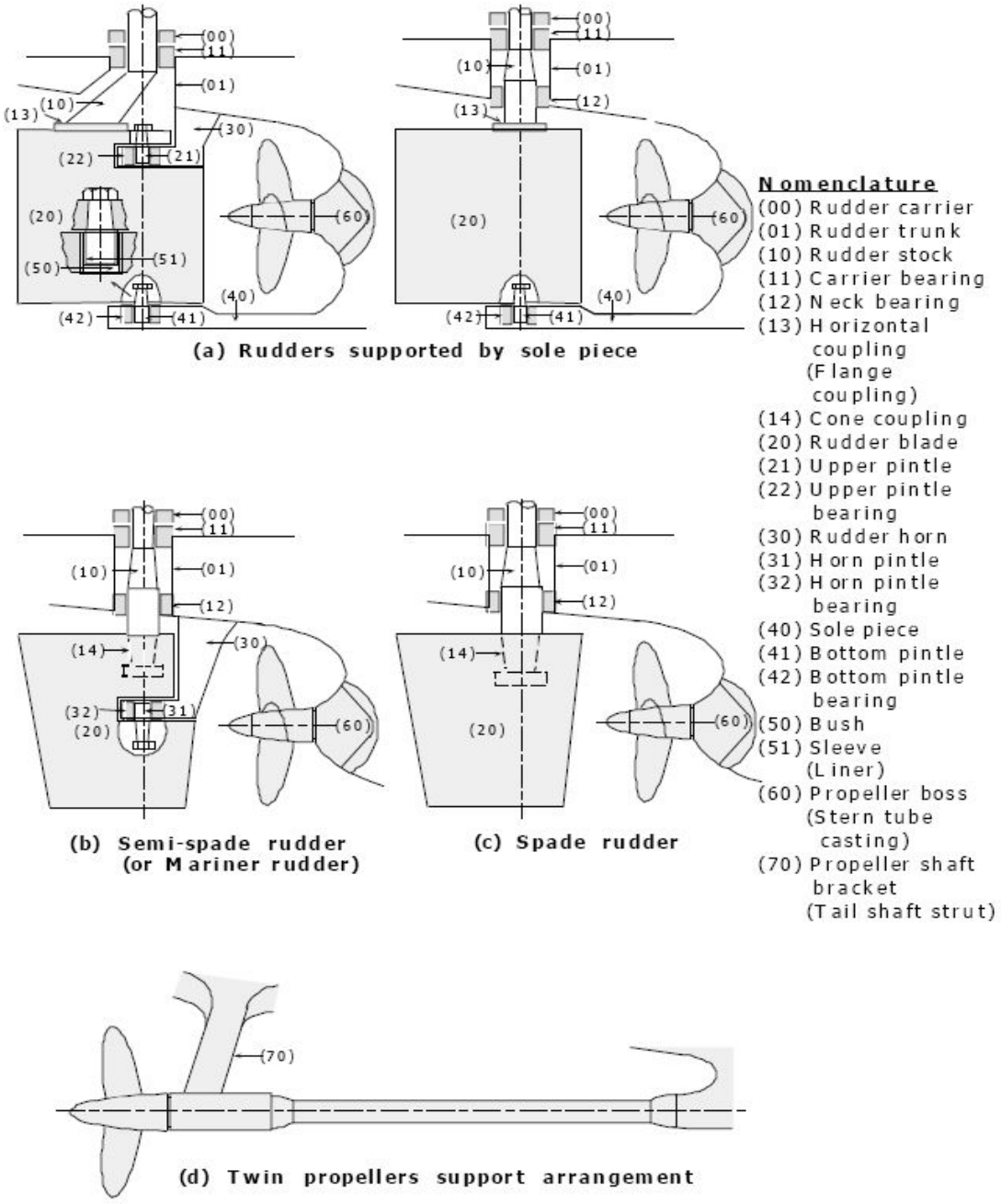

Figure 1 Nomenclature for stern frame, rudder arrangement and propeller shaft support

REFERENCES:
CONARINA SURVEYOR INSTRUCTIONS - CLASSIFICATION

ATTACHMENTS:
No.

Kindest Regards,
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