CIMAC
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CIMAC Guideline

Hydraulics and Lubrication Rules of Steerable Thrusters

1st Edition

From the CIMAC Working Group 21 ‘Propulsion’

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The first edition of this CIMAC Guideline was approved by the members of the CIMAC Working Group 21 ‘Propulsion’ at its meeting on April 20, 2021.

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Abstract

Rules for hydraulic and lubrication units have differences between each classification society. There are additional complications with differing interpretations within a single Classification Society that can vary considerable between countries. All this complexity is forcing hydraulic and lubrication component and system suppliers to build their processes to meet the requirements of the hardest surveyor inside their operating region. This is resulting in an uncompetitive position for the OEM, builders and suppliers which is increasing system costs to an unacceptable and unnecessary level.

This paper is collection of questionable or unclear rules from classification societies, prescriptive rules for hydraulic system for steering systems and propulsion units. Each selected rule is considered as written and our aim is to explain the issues with the current rules and come up with a guidance note proposing how the rule should be considered for ensuring the safety of the component and/or system design.

1 Introduction

Classification society rules for steering and propulsion units should be guiding hydraulic and lubrication component and system builders (called supplier) in providing consistent standard quality solutions for these essential services.

Global steerable thruster builders and suppliers are changing factory locations and operating countries to optimize their product costs. This is causing the manufacturers to engage with different people inside and between classification societies. We have seen that interpretation of the rules within a classification society and between societies can have significantly differing interpretations which has resulted in a significant increase in equipment costs caused by materials or components.

CIMAC WG21 Steering and Propulsion is acting by writing this guidance note to IACS as a voice of industry to request that IACS consider the implications of their rules and how they are applied to eliminating unnecessary extra work and over engineering. And thus, increasing overall productivity of the industry.

2 Inconsistency in Classification Rules

Below are some examples of rules that are either not 100% applicable for today's industry, are being applied inconsistently between classification societies or are causing challenges that are not technically possible to overcome by OEMs or component suppliers.

2.1 Test pressure for hydraulic systems

Hydraulic systems for maritime industry are to be pressure tested before system or machine can be accepted for operation. Static test pressure has been practically 1,5 x safety pressure (safety pressure SP equals to opening pressure of the pressure relief valve) stated in system or subsystem drawings up to 210bar working pressure level. For high pressure systems the pressure is increased by 70bar. Some society rules are still demanding 1,5 x SP as well for high pressure systems, but there is great inconsistency between surveyors with this rule.

350bar safety pressure is more and more typical due to pressure to increase power density of hydraulic systems. In this case SP x 1,5 is causing problems for system manufacturers because components, part of the same system, cannot tolerate 525bar test pressure and thus needs to be removed before static pressure testing and to be replaced by cavity plugs or blind plates. All components have a high safety factor against burst and this is not the problem. Challenge is internal parts and internal seals that are designed to be used in hydraulic systems with safety relief valves limiting the pressure to maximum SP + 70bar safety margin. System is as strong as it's weakest point, so removing or eliminating parts of system to manage the 525bar pressure testing does not make sense.

Updating all system components having internal parts and seals withstanding 525bar static pressure testing pressure is not an option with component availability and it does not make sense from a cost point of view.

We encourage IACS to consider the following when demanding static pressure testing:

1. SP is equal to opening pressure of the pressure safety valve.

2. 1,5 x maximum working pressure (SP) stated in system or subsystem drawings up to 210bar SP level, with a maximum value of 280bar. For higher pressure systems SP +70bar is to be used.

2.2 Aluminium pumps powering essential services

The maritime industry has been in favor using aluminum gear pumps for application in medium system pressure levels due to the robustness of the pumps and cost. Aluminum pumps are also used for essential service applications as submerged, PTO and outside tank pumps.

According to the classification rules aluminum is not accepted as a material for essential service applications due to a melting temperature below 925°C. From these points of view, aluminum pumps or any other aluminum components should not be used in the Marine industry.

Some modern vessels are using aluminum material in the ships hull and other components of the vessel. We question the requirement to protect hydraulic system to be able to withstand 925°C ambient temperature as in the event of a fire melting of an hydraulic pump is one of the smallest problems the ship will face.

For decades, common practice has been to accept aluminum pumps for the statements made above. There are a significant number of commercial vessels with pumps conflicting with the current rules and from our point of view the current rules do not make sense in the case of the melting point of these metal materials.

We encourage IACS to consider the following for aluminum pumps and other components:

1. Aluminum pumps, valves, filter housings etc. components can be used in the systems for essential services. We propose lowering the melting point limit down to 600°C to allow commonly used metal materials like aluminum, bronze, messing and brass as accepted materials.
2. Steel material should be still required for oil tank, inspection cover and metal-metal seated valves or fire-resistant ball valves isolating tank in case of fire. For high speed aluminum hull vessels, aluminum can be used as well in the hydraulic tank structure.
3. Aluminum pumps can be used as spare part pump for existing ship fleet according to original system BOM. Pumps need to have unique serial number and it must be 3.1 FAT tested by pump supplier.

2.3 Material papers for standard hydraulic valves

According to rules 3.1 material papers with traceability are required for pressure retaining components of separately specified applications and components included in those.

For pumps and other components this rule is applicable for pressure retaining parts where pressure is greater than 7bar. Housings holding the low pressures are not and should not require 3.1 material papers due to maximum pressure below 7bar.

With hydraulic manifolds 3.1 material papers are requested for manifold steel and other non-standard flanges or pressure retaining components.

Some surveyors have started to demand 3.1 material papers as well for standard catalogue items like NG valves, standard DIN covers and screw in cartridge valves. This is causing great delivery time and cost challenges due to fact that standard hydraulic components are not available with 3.1

material papers with needed full traceability. In some projects, suppliers have been forced to build customer special valves to meet the material traceability demand. Standard valve produced in high quantities is always safer solution that one-off special deliveries. Internal and external quality standards of all well-known hydraulic component builders are far beyond the marine society's rules for hydraulic components and thus we should trust these.

We encourage IACS to to consider the for standard hydraulic catalogue components:

1. 3.1 material papers are not requested for standard hydraulic valves, covers, flanges, pressure gauges etc. in case those well-known catalogue items from supplier with certified ISO 9001 quality system. Component data sheets with sufficient EN 10204 Type 2.2 statement should be attached as part of the system documentation.
2. Above mentioned valves can be part of manifold, pump or any subsystem or HPU without 3.1 material paper requirement.

2.4 Material papers of electric motors

Classification societies have mixed limits from what capacity they require electrical motors to be inspected during construction and testing which is confusing for several reasons. The power limits are 50kW (CCS & RMRS), 300kW (DNVGL) and 100kW (others). From this limit upwards 3.2 approved motors are required.

There is also an issue with the requirement for Type approval of motors and in some cases how the motor will be controlled. From a safety perspective, the difference in power rating between the Class Societies is not only confusing but adds complexity to the overall safety argument. We also do not understand how the control of these motors should influence the requirements for survey of these machines.

The rule itself makes sense, but the limits should where possible be aligned, as we have been advised that machines up to 300kW are considered as standard items and are all built under very strict QM processes.

We encourage IACS to to consider the following and kindly request they align their survey requirements for electrical machines:

1. Only electric motors with a higher nominal power than 300kW are to be supplied with 3.2 documentation.
2. Electric motors below 300kW, used for essential service equipment in maritime industry, are to be supplied with 3.1 EN 10204 test certificate.
3. Above mentioned documentation requirements are valid for electric motors powered by frequency-controllers and motors powered by conventional started cabinets.

2.5 Acceptable location for 3.2 witness testing

According to rules 3.2 witness testing should performed at original component/system builder premises under classification societies representatives witness. This is clear and good rule, but again there are great interpretation differences what are causing unnecessary costs and complexity.

Interpretation differences are related to meaning of the original component producer. Some surveyors are considering that place of original component production is the factory where pump is assembled. Some include technical centres configuring pumps from components or from subassemblies to be suitable as place to perform 3.2 witness testing.

From technical or safety point view there is no difference where the pump is tested as long as test station is able in providing needed flow and pressure for pressure and functional testing and test location is having valid ISO 9001 certificate confirming high quality workmanship.

All most recognized hydraulic producers are doing global business with global customers in a global industry as maritime industry is. Normally pumps are built in a factory somewhere and shipped to local distribution centres close to customer or to a system integrator. Having 3.2 witness tested pumps for all IACS societies in all main countries makes no sense. Producing pumps on demand from the factory do not correlate to needed lead times and thus no option. This is problem especially in China with various societies.

We encourage IACS to to consider the for accepted location of 3.2 witness testing of hydraulic pumps, components and systems:

1. 3.2 witness testing of hydraulic pumps, motors or any other components can be performed by any certified service, repair or manufacturing location with valid ISO 9001 quality certification. The location must have test station being able in providing needed flow and pressure for pressure and functional testing and test location must have valid ISO 9001 certificate confirming high quality workmanship.

3 Summary

This document is part of the work of CIMAC WG21 Steering and Propulsion, Subgroup: Hydraulics, Cooling and Lubrication.

It presents five examples of the classification society rules having interpretation differences or clear rule differences causing unnecessary costs and complexity for steering and propulsion equipment builders.

The document can be revised and extended in case it will be proven that this is a working channel communicating with classification societies.

The document explains these samples, proposing corrective actions and recommending IACS approaching societies to recommend corrections in these rules in the next versions of their rule sets.

Imprint

CIMAC e. V.
Lyoner Strasse 18
60528 Frankfurt
Germany

President: Prof. Dr. Donghan, Jin
Secretary General: Peter Müller-Baum

Phone +49 69 6603-1567
E-mail: info@cimac.com

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