Regional Citizens' Advisory Council / *"Citizens promoting environmentally safe operation of the Alyeska terminal and associated tankers."*

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Memo from Executive Director Donna Schantz on the Attached Prince William Sound Regional Citizens' Advisory Council Report titled "Industry and Class Standards for Escort Tugboat"

The Prince William Sound Regional Citizens' Advisory Council (PWSRCAC or the Council) is an independent, nonprofit corporation whose mission is to promote the environmentally safe operation of the Valdez Marine Terminal and associated tankers. Our work is guided by the Oil Pollution Act of 1990, and our contract with Alyeska Pipeline Service Company (Alyeska). PWSRCAC's 18 member organizations are communities in the region affected by the 1989 Exxon Valdez oil spill, as well as commercial fishing, aquaculture, Native, recreation, tourism, and environmental groups.

By July 2018, Edison Chouest Offshore will replace Crowley Maritime as Alyeska's marine services contractor. The services under this contract include providing escort tugs, general purpose tugs, oil recovery storage barges, and associated personnel, all of which are key oil spill prevention and response assets for the Valdez Marine Terminal and associated oil tankers operating in Prince William Sound. As part of this transition, Edison Chouest Offshore is building five escort tugs, four general purpose tugs, and four oil spill response barges. The Council is working to ensure the escort tugboats used for the Prince William Sound oil spill prevention and response system represent the best practices adopted for this equipment worldwide. As part of this process, the Council commissioned the attached report titled, "Industry and Class Standards for Escort Tugboats."

Escort tugboats are designed to stop or turn a tanker when needed to prevent an accident and tow it to a safe location. These vessels accompany loaded oil tankers out of the Sound and are ready to save a tanker that experiences mechanical problems. Tugs not specifically designed for this work can be rolled or damaged by the forces generated from a moving oil tanker

This report serves as a reference document, detailing recognized standards for escort tugboats as addressed among a number of different organizations. The Consultant uses a review of ASTM International (formerly known as the American Society for Testing and Materials) Standard F1878-98 titled, "Escort Vessel Evaluation and Selection," as the foundation for a cross-referenced comparison to international, federal, and state tanker escort standards.

The Council is not endorsing this ASTM International standard in particular, but it conveniently provides a framework for describing other recognized standards for these vessels. Document F1878-98 was compared to standards promulgated by Det Norske Veritas (DNV), American Bureau of Shipping (ABS), Code of Federal Regulations 33 CFR 168, and Lloyds Register.

The Contractor was also tasked with developing a summary of what modeling, simulations, and tests were required to verify the current escort tug and response system capabilities and identify supporting documents that provide more detailed information. This summary and associated supporting documents are being compiled, and it is anticipated they will be made available at a later date to those wanting more information.

Attachment: Report titled “Industry and Class Standards for Escort Tugboats” by Little River Marine Consultants, January 28, 2017

Regional Citizens' Advisory Council

Industry and Class Standards for Escort Tugboats

Prepared for:
Prince William Sound Regional Citizens' Advisory Council
Valdez, Alaska

Prepared by:
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P.O. Box 504
East Boothbay, ME 04544
Date: January 28,2017

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1.0 BACKGROUND

Alyeska Pipeline Service Company (Alyeska) is changing their marine services provider from Crowley Marine Services to Edison Chouest Offshore in July 2018. The marine services contractor provides escorts and general purpose tugs, oil spill recovery barges, and the associated personnel to operate these vessels and others in the Alyeska system. Little River Marine Consultants was retained by Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) to develop a summary of modeling, simulations, and full-scale testing identified by the industry and classification societies for escort tugs in the U.S. and around the world. As part of this process, Little River Marine Consultants developed the summary contained in this report of recognized standards for escort tugboats as addressed among a number of different organizations, and identified supporting documents as an attachment to this document. This supporting reference summary is just one piece of the overall effort by the PWSRCAC, intended to help develop recommendations to Alyeska, the Prince William Sound Shippers, and regulatory agencies.

2.0 REFERENCE MATERIAL

The following information was either provided by the PWSRCAC, produced from LRMC files, or downloaded from the Internet and was used as the basis of this comparison:

a. ASTM Designation: F1878-98 (Reapproved 2015) *Escort Vessel Evaluation and Selection*
b. Det Norske Veritas (DNV) *Rules for Classification of Ships Offshore Service Vessels, Tugs and Special Vessels,* Part 5, Chapter 7, Section 13, Escort Vessels, July 2012, pp.78-81 https://rules.dnvgl.com/docs/pdf/DNV/rulesship/2012-07/ts507.pdf
c. ABS *Rules for Building and Classing Offshore Support Vessels*, 2017 - PART 5 SPECIALIZED SERVICES pp. 214-291 http://ww2.eagle.org/content/dam/eagle/rules-and-guides/current/conventional_ocean_service/5_steelvesselsunder90meters_295feet_length/U90M_Part_5_e-Jan17.pdf
d. Code of Federal Regulations Document: 33 CFR Part 168 *Escort Vessels for Certain Tankers, Final Rule* https://www.law.cornell.edu/cfr/text/33/part-168
e. Lloyds Register *Rules and Regulations for the Classification of Ships,* Part 4, Chapter 3, Section 9– Ship Structures, July 2016 http://www.lr.org/en/RulesandRegulations/ships.aspx
f. American Bureau of Shipping *ABS Notations and Symbols – 29 January 2015,* Offshore Support Vessels – (Escort) p.172 https://www.eagle.org/eagleExternalPortalWEB/ShowProperty/BEA%20Repository/Rules&Guides/Generic/ListofABSNotationsandSymbols

3.0 SCOPE OF WORK

Review ASTM Designation: F1878-98 (Reapproved 2015) “Escort Vessel Evaluation and Selection” and provide a cross-reference with international, federal, and state tanker escort standards. Identify supporting documents that provide more detailed information that can be referenced in the summary and provided as an attachment or distributed later to those wanting more information.

4.0 ASTM DESIGNATION: F1878-98 OVERVIEW

This guide discussed the evaluation and selection of tanker escort vessels transiting confined waters and was intended to be used in performance-based analysis to evaluate the control requirements of a disabled ship, capabilities of escort tugs, and navigational limits and obstacles of waterway.

The main goal of this guide is to provide an overview of the methodologies used to determine the factors that are important in developing and implementing an escort plan given a known geographic area, design of escort tugs, and class of tanker being escorted. These key factors included the size, bollard pull (direct, indirect), crew make up, maneuvering characteristics, stability of the tug, transit speed, winds, currents, sea conditions, and hull data of the tanker. Methods used to make these determinations include formulae that can be used directly; in other instances, in which the interaction of various factors is more complicated, it presents analytic processes that can be used in developing computer simulations.

The guide’s operational performance measures are based on existing rules and regulations that are in practice at this time utilizing 33 CFR 168.50, Part (a), (1), (2), and (3) to develop Performance Measures used during a tanker escort suggesting that an operational analysis needs to consider transit speed, time delays, sea and weather conditions, navigational constraints, failure modes, type of assistance used, ship fitting, and other factors.

Additionally, ASTM DESIGNATION: F1878-98 emphasizes the importance of conducting both computer simulations and full-scale ship escort trials to verify the adequacy of the escort tugs. However, the guide cautions that the full-scale trials may take place in conditions different from actual emergency conditions and the fact the crew will be fully prepared for the test. Thus, time delays obtained in these tests will, in most cases, underestimate the time required in a true emergency.

In summary, ASTM DESIGNATION: F1878-98 does not establish any operational, regulatory, or class standards but does offer insight as to the methods available to analyze the key factors and theories of establishing an effective escort plan.

5.0 DET NORSKE VERITAS (DNV) *RULES FOR CLASSIFICATION OF SHIPS OFFSHORE SERVICE VESSELS, TUGS AND SPECIAL VESSELS,* PART 5, CHAPTER 7, SECTION 13, ESCORT VESSELS (2012)

DNV (Norway) provides classification, verification, risk-management, and technical advisory to the maritime industry on safety, enhanced performance, fuel efficiency, etc. As a classification society, DNV sets standards for ships and offshore structures known as Class Rules with which vessels in international waters must comply. DNV is authorized by 130 maritime administrations to perform certification or verification on their behalf. DNV is the world's largest classification society with 13,175 vessels and mobile offshore units (MOUs) amounting to 265.4 milllion. gross tons in its portfolio, which represents a global market share of 21percent.

Section 13 of the rules for classification of ships, New Builds, Special Service and Type, Additional Class (Escort Vessels), DNV establishes the additional requirements for tugs to be classed as specially intended for escort service or designated as **Escort (n,V)**. Under Section 13, there are five (5) subsections. Section A Definitions lays out the specifics of certain terms that are part of the class process. This process is specific to the performance of the escort tug and the establishment of a common expectation of vessel performance.

Important terms identified:

1. *Escort service* includes steering, braking, and otherwise controlling the assisted vessel. The steering force is provided by the hydrodynamic forces acting on the tug's hull. See Fig. 1.

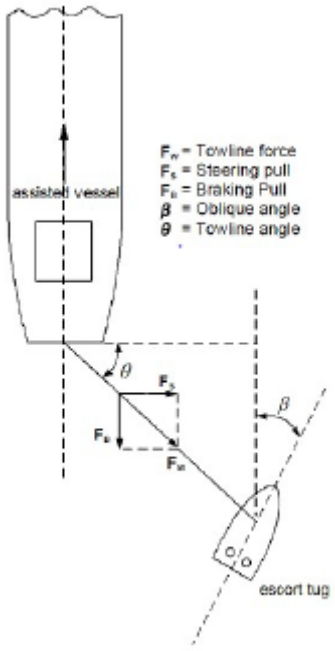


Fig 1

2. *Escort test speed* is understood to be the speed at which the full-scale measurements shall be carried out, namely 8 knots and/or 10 knots.
3. *Escort tug* is understood to be the tug performing the escort service.
4. *Assisted vessel* is understood to be the vessel being escorted.

5. *Escort rating number* (**Fs,t,V**) **Fs** is defined as the steering force in metric tons exerted on the stern of the assisted vessel with the intention of controlling it, **t** is the time required for the change of the tugs position from one side to the corresponding opposite side, and **V** is the speed at which this pull may be attained. If trials take place at both 8 and 10 knots, the escort rating number will consist of six digits. See Fig. 1

Requisites for classification:

1. The hull of the tug shall be designed to provide adequate hydrodynamic lift and drag forces when in the indirect towing mode.
2. Due attention shall be paid to the balance between hydrodynamic forces, towline pull, and propulsion forces.
3. Freeboard shall be arranged so as to avoid excessive trim at higher heeling angles.
4. A bulwark shall be fitted all around exposed weather deck.
5. The towing winch shall have a load-reducing system in order to prevent overload caused by dynamic oscillation in the towing line.
6. Normal escort operation shall not be based on use of brakes on the towing winch.
7. The **towing winch shall be able to pay out towing line if the pull exceeds 50 percent of the breaking strength of the towing line.**
8. The towing line shall have a **breaking strength of at least 2.2 times the maximum mean towing pull as measured during the test.**
9. The propulsion shall be able to provide ample thrust for maneuvering at higher speeds for tug being in any oblique angular position.
10. The vessel shall be designed so that forces, when in the indirect mode, are in equilibrium with a minimum use of propulsive force except for providing forward thrust and balancing transverse forces during escorting service.
11. In a case of loss of propulsion, the remaining forces shall be so balanced that the resulting turning momentum will turn the escort tug to a safer position with reduced heel.
12. The area under the righting arm curve and heeling arm curve shall satisfy the following ratio:
    a. RABS ≥ 1.25 (RABS = ratio between righting and heeling areas between equilibrium and 20 degrees heeling angle). Equilibrium is obtained when maximum steering force is applied from tug. See Fig. 2.

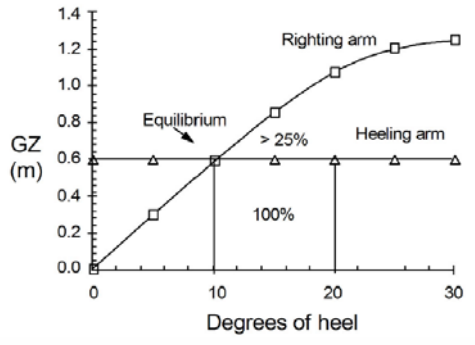


Fig. 2

13. Possible model testing should include heeling angle measurements to predict dynamic stability margin.
    a. This requires a high degree of accuracy in determining light ship weight and center of gravity.
14. Full-scale testing:
    a. A plan with documentation covering the full-scale trials shall be approved prior to the trials being undertaken.
    b. The documentation shall include a towing arrangement plan showing different components in towing gear including the load cell. Verification of SWL of strong points onboard the assisted vessel shall be submitted.
    c. The escort test speed is 8 knots and/or 10 knots. (The speed should be taken relative to the sea.)
    d. Recordings during full scale trials:
        i. At least, the following data shall be recorded continuously in real-time mode during trials for later analysis:
            1. Position of assisted vessel and escort tug shall be recorded by differential GPS equipment.
            2. Speed of assisted vessel by differential GPS
            3. Speed of assisted vessel by log relative to the sea
            4. Heading of both vessels from gyro compasses
            5. Rudder angle on assisted vessel
            6. Heeling angle on tug
            7. Towline tension
            8. Length of tow line
            9. Angle of tow line
            10. Weather condition and sea state shall be noted, manual measurements shall be read as back-up to continuous readings
            11. Bearing from tug to assisted vessel shall be recorded
            12. Assisted vessel shall sail on auto pilot during trials
            13. Size of vessel shall be sufficient as to withstand steering forces from tug without using too large angles

6.0 ABS *RULES FOR BUILDING AND CLASSING OFFSHORE SUPPORT VESSELS* 2017 - PART 5 SPECIALIZED SERVICES

ABS Part 5 Chapter *SPECIALIZED SERVICES 13 ESCORT VESSELS (2017)* has been moved from the Rules for Building and Classing Steel Vessels Under 90 Meters in Length, in an effort to include Offshore Support Vessels (OSV) as that class now participates in the same work. These rules are virtually the same as the Rules for Building and Classing Steel Vessels Under 90 Meters in Length (2006) with some additional definitions to include OSV Escorts. Examination of the SERVS provided ECO plans of the DAMEN 4517 Escort Tug indicate that, by the classification of ✠ **ESCORT**, these tugs were built under the 2006 rules as opposed to the 2017 rules. Since the 2006 rules are virtually the same as the 2017 rules, the rules will be addressed as the same.

Important terms identified:

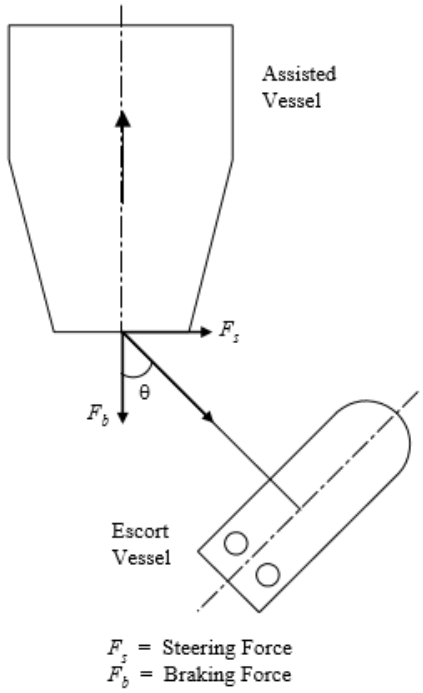
In sections 1 General, 2 Plans and Data, and 3 Definitions, basic guidelines are described with interest focused on the terms Bollard Pull, Direct, and Indirect towing:

1. *Bollard Pull* - Bollard pull is a conventional measure of the pulling (or towing) power of a vessel. It is defined as the force (in tons or kilo Newtons (kN)) exerted by a vessel under full power, on a shore-mounted bollard through a tow-line, commonly measured under test conditions that include calm water, no tide, level trim, and sufficient depth and side clearance for a free propeller stream. It is to be determined by an approved static bollard pull test performed in the presence of the Surveyor. Static Bollard Pull Test Procedure is to be submitted to ABS for review. Bollard Pull is not to exceed escort line force limited by the stability criteria for escort operations.

   The static bollard pull test procedure is to be submitted for review by the attending Surveyor in advance of the test. A bollard pull test is required for each vessel being classed Escort Service. The static bollard pull is to be measured with the escort vessel at the maximum continuous rpm and at or near its maximum displacement. It is the pull that is recorded over the state of equilibrium without any tendency to decline. The depth of water and the extent of water abaft and abreast the vessel is to be adequate to give a reliable bollard pull.

2. *Dynamic Pull* – Dynamic pull, given at a particular speed, is the maximum sustainable force that the escort vessel is able to develop while the assisted vessel is moving through the water at that particular speed. This force, a measurement of the steering capability of the escort vessel, is the resultant of a pair of speed-dependent vector force functions; a maximum steering force, **Fs**, and an associated braking force, **Fb**. This maximum force will be generated at some angle, **θ**, between the line of pull and the direction of the vessel being assisted. See Figure 1.

FIGURE 1
Dynamic Pull Forces



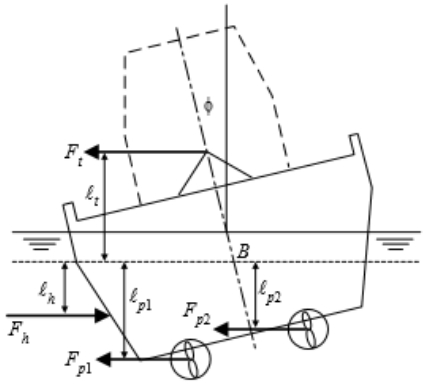
3. *Direct Towing* - Towline force is derived directly from the escort vessel's propulsion system.
4. *Indirect Towing* - Hydrodynamic lift and drag forces created by water flow against the escort vessel hull is utilized to develop towline forces.

Requisites for classification as ✠ A1 Offshore Support Vessel (Escort):

1. *Intact Stability* - The intact stability of the vessel is to comply with a recognized standard. The submission of evidence showing approval by an Administration will be acceptable. Alternatively, upon request, the review will be performed by ABS. The following dynamic factors are to be accounted for:
    a. The stability analysis is to consider all potential attitudes of the escort vessel relative to the direction of line pull, the maximum line pull, and the resultant combination of heel and trim on the escort vessel.
    b. The stability analysis is to include the effects of fenders, skegs, and other appendages on both the reserve buoyancy and the lateral resistance of the escort vessel.
    c. The stability analysis is to include the contribution to heel and trim of the propulsion system in conjunction with maximum line forces.
    d. The stability analysis is to include an evaluation of the reaction of the escort vessel to an instantaneous release of the line forces and the propulsive forces.

e. A heel-angle limit is to be established. **Forces acting on the escort vessel are not to submerge the deck edge.**

FIGURE 1
Dynamic Stability Components



F_t	=	Towline Pull Force, in metric tons (long tons)
F_{p1}, F_{p2}	=	Propulsion Thrust Forces, in metric tons (long tons)
F_h	=	Hull and Appendage Force, in metric tons (long tons)
ℓ_t	=	Towline Pull Force Arm, in m (ft)
ℓ_{p1}, ℓ_{p2}	=	Propulsion Thrust Forces Arms, in m (ft)
ℓ_h	=	Hull and Appendage Force Arm, in m (ft)
ϕ	=	Heel Angle, deg.
Δ	=	Vessel Displacement, in metric tons (long tons)
M_t	=	$F_t \ell_t \cos \phi$
M_{p1}	=	$F_{p1} \ell_{p1} \cos \phi$
M_{p2}	=	$F_{p2} \ell_{p2} \cos \phi$
M_h	=	$F_h \ell_h \cos \phi$

Heeling Arm = $\dfrac{M_t + M_{p1} + M_{p2} + M_h}{\Delta}$

Heeling arm curve should be taken to vary with the cosine of the heeling angle.

2. *Towing Gear* – The key requirement of importance in this section centers around the strength of the towline. The requirement for a towline used in the escort service requires ***the breaking strength*** **not to be less than two times the static bollard pull load where DNV requires 2.2 times the bollard pull**
3. *Tow winch* – The towing winch is to be capable of sustaining the breaking strength of the towline without permanent deformation.

Vessel Design Requirements:

1. The requirements for vessel design are consistent with DNV design strength and structure with no notable deviations in the DAMEN 4517 plans.

Verification of Steering Capability Requirements:

1. *Testing Requirements* – In order to be classed as ✠ **ESCORT** in the 2006 Rules or ✠ **A1 Offshore Support Vessel (Escort)** in the 2017 rules, the vessel is required to submit to testing to demonstrate that it is capable of producing the performance needed to escort tankers in the designated area and size utilized.
    a. Full-Scale Testing Requirements:
        1. The following data is to be collected at the full-scale trials:
            a. A continuous recording of the ship and escort vessel positions during the course of the trial
            b. A recording of the ship and escort vessel headings during the course of the trial
            c. Towline tension
            d. Angle of towline
            e. Heel angle of escort vessel
            f. Readings for *b)* through *e)* are to be taken at a maximum interval of 10 seconds
            g. Environmental conditions are to be noted, including weather, sea state, wind, current, water depth
            h. The ship's and escort vessel's loading conditions are also to be noted
    b. Computer Model Simulation Requirements:
        1. *The computer modeling program* should be suitable to the type of ship and escort vessel being modeled. It should also be suitable for the waterway bathymetry being modeled. The calculation for the steering capability of the escort vessel should correspond to a quasi-steady-state condition where the horizontal-plane forces and moments are balanced. Non-linear effects can be considered negligible. The analysis is to include the hydrodynamic forces on the escort vessel's hull and underwater appendages, the forces acting on the rudder, and the propulsive thrust. The escort vessel's stability and attitude are to be considered in the analysis.
        2. *Steering capability* of an escort vessel is analyzed to verify its ability to tow the disabled ship at a specified speed in calm conditions and holding it in a steady position against specified head wind. Where an escort vessel is working in contact with the disabled ship's hull, steering capability will be reviewed on a case-by-case basis. The factors to be included in analysis are forces and moments, angles of attack of the hull and skeg to free stream, heel angles, wave run-up, and residual freeboard. The quasi-equilibrium is to be calculated to deck edge submergence only.
        3. *The computer model* simulation is to include the following components of a steady-state escort vessel performance analysis:

a. Lift, drag, and center of pressure of hull
b. Lift, drag, and center of pressure of skeg including effects of aspect ratio
c. Cross-flow effects as a result of tug orientation with respect to the free stream
d. Effects of fendering on hydrodynamic performance of the hull
e. Propeller performance, including engine, gearbox, and shafting characteristics; command RPM; and propeller geometry
f. Effects of twin screw control
g. Lift, drag, and center of pressure of propeller nozzles, if applicable
h. Heeling moments caused by bow lines (if rigged) and transverse components of hull, skeg, rudder, nozzle, and propeller forces
i. Heeling moment caused by towline tension
j. Freeboard and GM in the design condition and escort condition
k. Reduction in freeboard as result of average wave amplitudes
l. Deck edge submergence
m. Forces in lines
n. Position of tug on ship, either alongside on the transom or on a line
o. Use of additional thrusters, if necessary

7.0 33 CFR PART 168 *ESCORT REQUIREMENTS FOR CERTAIN TANKERS* (2002)

33 CFR Part 168 prescribe federal regulations directing the minimum escort requirements in accordance with section 4116(c) of the Oil Pollution Act of 1990 (OPA 90) to reduce the risk of oil spills from laden single and double hull tankers over 5000 gross tons and requires the escort of two suitable escort vessels. The areas identified in a following section (§168.40) are Prince William Sound and Puget Sound, although San Francisco and the ports of Los Angles and Long Beach, CA have adopted similar regulations.

Performance Requirements:

1. The escort vessels, acting singly or jointly in any combination as needed, and considering their applied force vectors on the tanker's hull, must be capable of:
    a. Towing the tanker at 4 knots in calm conditions and holding it in a steady position against a 45-knot headwind;
    b. Holding the tanker on a steady course against a 35-degree locked rudder at a speed of 6 knots; and
    c. Turning the tanker 90 degrees, assuming a free-swinging rudder and a speed of 6 knots, within the same distance (advance and transfer) that it could turn itself with a hard-over rudder.

2. The importance of this requirement reflects back to the modeling necessity for both computer and full-scale testing and sets the parameters for escort performance and to achieve the ✠ **ESCORT** Escort Classification within the classification Societies.

Other Requirements:

1. Other requirements of 33 CFR 168 necessitate a pre-escort conference prior to commencing an escorted tanker transit to discuss particulars of the attended route. Although this is in the regulations, it has no bearing on the performance of the escort performance with the tanker.

8.0 Lloyds Register *Rules and Regulations for the Classification of Ships* Part 4, Chapter 3, Section 9 – Ship Structures, Escort Operation, performance and trials – (July 2016)

Lloyd's Register (LR) provides quality assurance and certification for ships, offshore structures, and shore-based installations such as power stations and railway infrastructure. However, Lloyd's Register is known best for the classification and certification of ships and inspects and approves important components and accessories including life-saving appliances, marine-pollution prevention, fire protection, navigation, radio-communication equipment, deck gear, cables, ropes, and anchors. A ship is known as being *in class*, if she meets all the minimum requirements of LR's Rules.

Performance Requirements of Escort Vessels:

1. *General description of Escort Tugs* - An escort tug is a tug intended for escort operation. Escort operation is an operation in which the tug closely follows the assisted ship providing control by steering and braking, as necessary. Escort tugs are to be capable of utilizing methods of towing through which steering and braking forces are generated by a combination of propulsive and hydrodynamic forces developed by the tug acting on the towline to the attended ship. This force diagram is similar to the diagram shown in ABS Rules Part 5, Figure 1.
2. *In discussing intact stability* of the tug during escort operation, the rules rely on the vessel conforming to the requirements of the classification society with whom the ship is registered. As with ABS and DNV, attention is drawn to the inherent problems relating to the quick release of the towline and the sudden loss of propulsion power during the escort operation in addition to the maximum steering and braking forces.
3. *Towing Arrangements* – LR has stricter guidelines for the strength of the towing equipment than ABS and DNV. The specified breaking strength of the towline is to be **at least 2.5 times the maximum design towline force**. The towing winch is to include a system of continuous load monitoring with a bridge readout display and an overload prevention system, which is to be operational during escort duties. The overload prevention system is to be designed with the capability to pay out the towline in a controlled manner when the load reaches the maximum design towline force, and is to be capable of alerting the Master and crew.

4. *Performance and Trials* - Escort tugs that carry out full-scale performance trials in accordance with the requirements of this Section will be eligible to have the escort performance numeral **EPN (F,B,V,C)** appended to the **escort tug** notations:

a. **F** is the maximum steering force **(F s**) in tons.
b. **B** is the maximum braking force (**F b**) in tons.
c. **V** is the speed, in knots, at which **F** and **B** are determined.
d. **C** is the time, in seconds (s), required by the escort tug for maneuvering from maintained oblique position of tug giving maximum steering force **F s** on one side of assisted vessel to mirror position on the other side.
e. The towline angle, **α**, need not be taken less than 30 degrees.
f. The performance numeral may be determined with speed **V** equal to either 8 knots or 10 knots.
g. A trials plan, which includes the estimated forces, is to be submitted and approved prior to trials being undertaken.
h. The trials of the escort tug are to be performed using a ship capable of maintaining almost constant heading and speed when subjected to the steering and braking forces from the escort tug.
i. The following trials are to be carried out in calm weather conditions and in the presence of a LR Surveyor:
    i. Steering and braking force capability test
    ii. Bollard pull test
j. A record of the results is to be kept on board the escort tug.

5. *Record keeping* requirement is consistent throughout the Classification Societies:
    k. Wind speed and direction
    l. Sea state
    m. Current speed and direction
    n. Water depth
    o. The main particulars and the loading condition of the assisted ship
    p. Loading condition of the escort tug
    q. Position, speed, and heading of the assisted ship and the escort tug
    r. Towline force, F t
    s. Angle of towline, α
    t. Heel angle of the escort tu.
    u. Direction of thrust and power absorbed by all propellers and thrusters of the tug
    v. Rudder angles of the tug
6. *Model testing* under Lloyds Register is not indicated to be required.

9.0 CONCLUSION

The classification societies' requirements to attain the Classification of ✠ **ESCORT** or similar classification are clear. In order to be classed in this manner, there is a requisite to conduct full-scale trials following the Societies' requirements, which may include model testing to demonstrate the steering, braking, and arrest forces of the tug.

Although the **DAMEN 3212** tug's particulars list it as **ABS Escort**, there is no indication the tug is built under the requirements for ABS Survey nor completed any of the required testing for Escort service.

	Vessels have been built under ABS survey	Vessels have not been built under ABS survey
Hull and Equipment:	✠ A1	A1
Machinery, boiler and systems	✠ AMS	AMS
Shipboard automation systems	✠ ACCU	ACCU