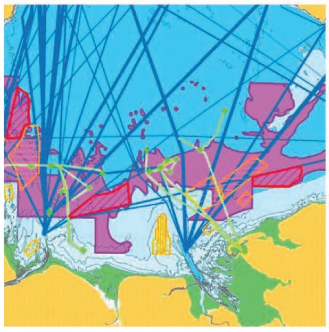
White Paper

The Challenge of Tanker Escort Towing

Ensuring a safe working load for tanker vessel fittings

April 2025

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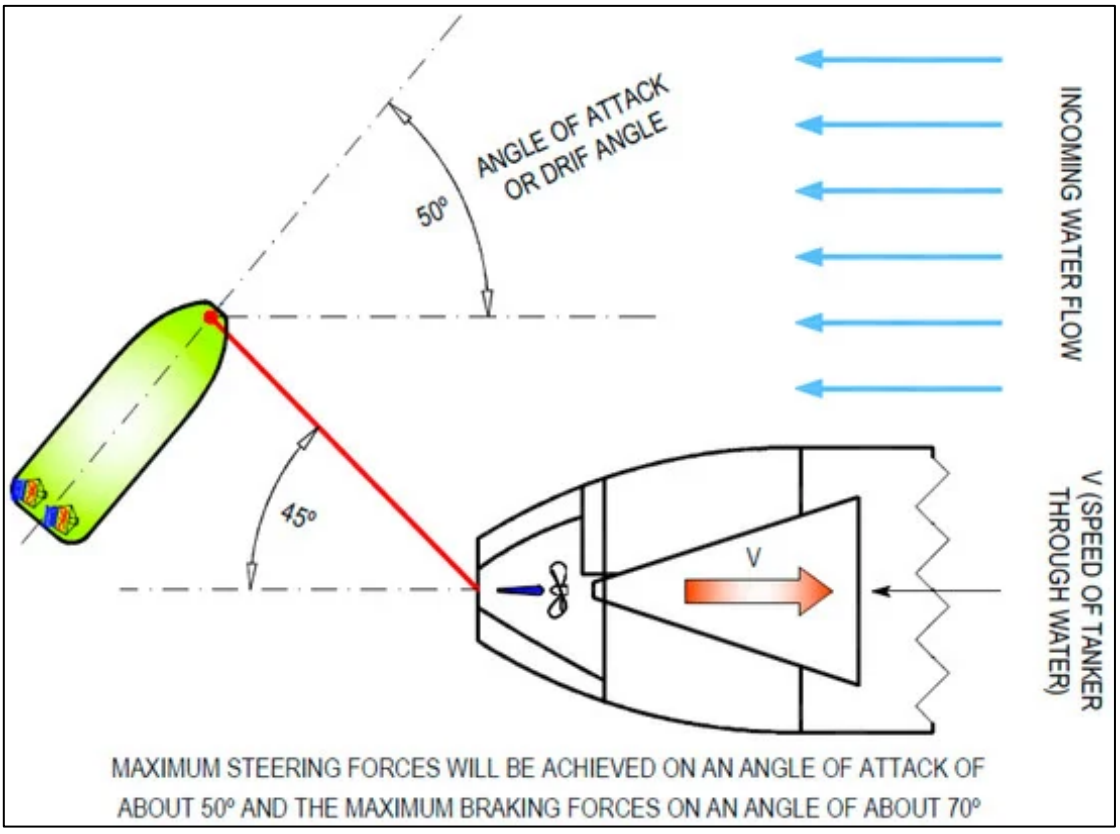
The Challenge of Active Indirect Tanker Vessel Escort Towing

Tanker vessel equipment used for active escort towing can be subject to forces significantly greater than static bollard pull of the tug when undertaking certain indirect escort methods. Failure of ships' fittings during active escorting can potentially lead to grounding or blockage of the navigational channel. However, there is no clear standard ensuring that such tanker vessels are designed with sufficient strength to withstand these potential forces.

Active escorting refers to the escorting tug being connected to the vessel being escorted rather than running alongside which is referred to as passive escorting. 'Indirect escort' refers to a method of towing where hydrodynamic forces generated by the water flow in relation to the aspect of the tug's hull, generate steering and stopping forces to mitigate mechanical failures during port approach or transit through restricted port waters. Figure 1 shows an Azimuth Stern Drive (ASD) escort tug operating in indirect mode.

Escort tug in active indirect towing mode Copyright Robert Allan Ltd

Many ports in the UK and beyond have identified 'active indirect escort towing' as a risk mitigation for grounding and/or channel blockage, should a tanker vessel suffer a loss of power and/or steering.



Open access: Ship Handling in Unprotected Waters - Iglesias-Baniela *et a,* 2021

Figure 1. ASD escort tug in active indirect towing mode adopting an angle of attack to generate maximum steering force

Rate of Turn (ROT) is a crucial parameter for ensuring safe and effective manoeuvring; this refers to the rate at which a vessel changes its heading or direction while navigating. The tug force (steering pull) required to provide the required ROT will depend on the size, displacement, speed and under keel clearance (UKC) of the vessel being escorted, combined with environmental factors and the geography of the port. Indirect escort towing manoeuvres are intended to either generate sufficient steering pull to induce the required vessel ROT or stopping force to safely slow the vessel and, in some cases, a combination of both.

Taking an example of a modern 100 tonne (t) Bollard Pull (BP)[1] escort tug, using indirect escort methods, operating at speeds of around 10 knots (kts) and an optimal incidence angle between the waterflow and the tug skeg it is possible that the escort tug could generate a steering pull up to two times the escort tug static BP (up to 200 t). The vertical angle between the tug's towing point and the vessel's fairlead or chock at the edge of the deck can also increase the force in the towline, particularly if the angle is acute. Environmental factors such as wind speed and sea state can also create snatch loads[2] through the towline that can increase the forces exerted through the towline.

Modern escort tug winches (termed 'render-recovery winches') maintain an almost constant towline tension up to the set limits of the winch brake. This is achieved through a rapid transition between rendering (letting out the towline) and recovery (hauling in the towline) reactive to the forces generated by wind and wave action on the tug. However, the Minimum Breaking Load (MBL)[3] of the escort tug's towline is likely to be three to four times the static BP of the escort tug, which may mean the tug winch brake force is set relatively high. The towline forces being monitored by the escort tug do not consider geometric forces that add a Force Multiplication Factor (FMF)[4] to the towline forces exerted on the fittings of the escorted vessel.

When an escort tug is positioned at a broad angle on the quarter of the vessel being escorted, a towline wrap angle is created around the fairlead or chock to the vessel towing strongpoint; this can multiply the towline force transmitted through the fairlead or chock significantly. Figure 2 shows the worst-case wrap angle of 180º, creating a Force Multiplication Factor (FMF) of 2.0.

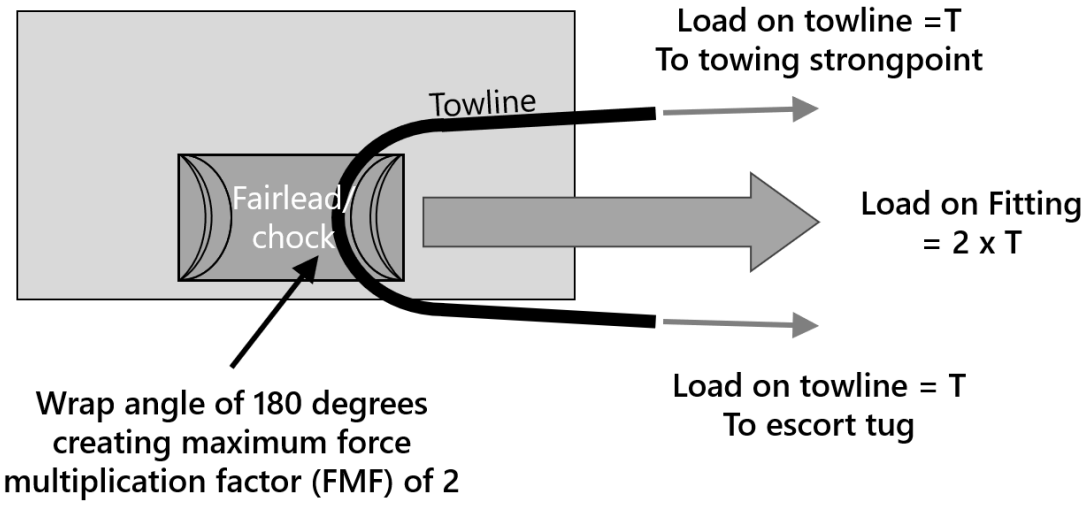


Figure 2. 180º wrap angle creating a FMF of 2.0

1 BP - Tugs are rated for Bollard Pull; a tug's towing capacity measured by the force it can exert when tethered to a bollard.
2 Snatch load is the additional increase in force due to the towline slackening then tensioning very quickly usually due to sea state.
3 The Minimum Breaking Load (MBL) is the minimum load that would cause a towing line to fail or break.
4 Force Multiplication Factor (FMF) is the increase in force exerted through the towed vessel fitting, beyond the towline force, e.g. as a consequence of the towline wrap angle through the fitting.

Taking the example above where the escort tug (generating up to 200 t of steering pull) is operating at 70º off the centreline, and there is a 20º angle between vessel fairlead or chock to the vessel towing strongpoint, a wrap angle of 90º is created at the fairlead or chock and a FMF of 1.4. Approximately 280 t of force could be acting on the fairlead or chock. This force is very likely to be significantly more than the SWL of the fairlead or chock and could lead to failure.

Industry rules and guidance

Strength requirements for mooring and towing are set out in the following publications:

- International Association of Classification Societies (IACS) Unified Requirements (UR) A2 Shipboard fittings and supporting hull structures associated with towing and mooring on conventional ships; and,
- International Maritime Organization (IMO) MSC.1/Circ.1175 Guidance on Shipboard Towing and Mooring Equipment.

These unified requirements have several iterations covering vessels built between 2007 and present.

These requirements and guidance are mainly intended to match mooring equipment strength to the MBL of the vessel mooring lines that is determined by the equipment number (EN) of the vessel. In most cases, the MBL of the vessel lines, determined by EN, is the weak link in the system and would part before the vessel mooring equipment is compromised.

Where the same unified requirements are applied to vessel fittings used for towing, they expressly only apply to what is termed as 'normal towing' (as opposed to active escort towing). The strength requirements are determined from the static BP of a harbour tug, plus a safety factor of 25%.

Emergency towing arrangements

Emergency Towing Arrangements (ETA), designed to facilitate the safe and efficient towing of vessels in distress, are an IMO Safety Of Life At Sea Convention (SOLAS) requirement for tanker vessels greater than 20,000 Dead Weight Tonnage (DWT).

All tanker vessels between 20,000 and 49,999 DWT must have ETAs for at least 100 t Safe Working Load (SWL). Tankers that are 50,000 and above must have ETAs for at least 200 t SWL.

ETA for tankers is not specifically intended for use when undertaking active escort towing. However, the Oil Companies International Marine Forum (OCIMF) recognises in their latest Mooring Equipment Guidelines (MEG-4), recognise that the IACS rules do not apply to the use of vessel equipment for escort towing and advocate the use of ETA, or equipment of equivalent strength and geometry where ETA cannot be used.

This creates challenges, as there is an implication that vessel equipment of 100 t SWL is appropriate for active escort towing for tanker vessels up to 49,999 DWT and that 200 t SWL is appropriate for active escort towing for tanker vessels of 50,000 DWT and above. When using indirect escort methods, a modern escort tug can introduce steering and/ or stopping forces in excess of these prescribed SWL requirements which may lead to ships' equipment failure.

Determining the required forces

'Tug use in Port' (Hensen, 2021), references Figure 3 to illustrate the rudder forces generated by typical oil tankers of 100,000 DWT and 200,000 DWT. It is recognised that each tanker vessel will have its own unique steering characteristics.

Tanker speed	100,000 dwt oil tanker Rudder angle:		200,000 dwt oil tanker Rudder angle:	
	15°	25°	15°	25°
6 knots	30 t	45 t	50 t	60 t
8	55	75	85	115
10	85	120	130	185
12	120	175	190	260

Figure 3. Rudder forces generated by typical oil tankers

While Figure 3 should be treated with caution due to its generality, it gives an indication of the Total Steering Pull (TSP) that may need to be provided by an escort tug in circumstances that a specific ROT is required to mitigate a loss of steering.

Conclusions

The key conclusions in respect to tanker vessel escort towing and the forces exerted on the vessel equipment are:

1. Industry rules and guidance that refer to vessel equipment strength requirements do not make provision for the forces capable of being generated in indirect escort towing methods.
2. The significant BP of modern escort tugs and indirect escort methods do not limit forces on the vessel equipment to within defined SWL requirements of IMO SOLAS ETA and MEG-4 guidelines.
3. The actual forces exerted are dynamic and can only be determined through consideration of the circumstances and requirements at the port where escort towing is being considered or are in place as a risk mitigation.

Who is responsible for setting escort towing requirements?

The UK ports sector operates self-regulation. Statutory Harbour Authorities (SHA) are therefore considered competent authorities for maritime safety within their own statutory limits.

The Ports & Marine Facilities Safety Code (PMSC) (DfT, 2025a) and accompanying Guide to Good Practice (GTGP) (DfT, 2025b) is the national standard for port operations in the UK. The PMSC states that organisations operating ports, terminals and maritime facilities, including SHAs and non-statutory organisations, should operate a proportionate Marine Safety Management System (MSMS) based on formal risk assessment.

It follows that the organisation with responsibility over the area that escort towing takes place is responsible to ensure the risks have been assessed, and appropriate requirements and procedures are in place. This is the case even if towing is being provided by a third party. Third party towing providers and vessels being escorted also have a responsibility to risk assess their own operations and establish safe systems of work.

Determining requirements for escort towing

ABPmer is experienced in working with organisations to determine the SWL requirement for tanker vessel fittings used for active indirect escort towing. The SWL requirement must consider the steering forces required to provide the specific mitigation as it applies to the actual vessels and circumstances at the port and the geometric and other factors that can influence the forces exerted on various parts of the overall towing system.

We encourage a collaborative approach to establish common understanding and a shared intended outcome for relevant stakeholders. If you would like to learn how ABPmer can assist your port or organisation to establish escort towing requirements and procedures, please get in touch with Captain Rod Lewis.

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Publication Sources

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Abbreviations/Acronyms

ABPmer	ABP Marine Environmental Research Ltd
ASD	Azimuth Stern Drive
BP	Bollard Pull
Circ	Circular (Publication)
DfT	Department for Transport
DWT	Deadweight Tonnage
EN	Equipment Number
ETA	Emergency Towing Arrangements
FMF	Force Multiplication Factor
GTGP	Guide to Good Practice
IACS	International Association of Classification Societies
IMO	International Maritime Organization
MBL	Minimum Breaking Load
MEG-4	Mooring Equipment Guidelines
MSC	Maritime Safety Committee
MSMS	Marine Safety Management System
OCIMF	Oil Companies International Marine Forum
PMSC	Ports & Marine Facilities Safety Code
ROT	Rate of Turn
SHA	Statutory Harbour Authorities
SOLAS	Safety Of Life At Sea Convention
SWL	Safe Working Load
TSP	Total Steering Pull
UK	United Kingdom
UKC	Under Keel Clearance
UR	Unified Requirements

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Glossary

Active escort:	When the escorting tug is connected to the vessel being escorted.
Bollard Pull:	A tug's towing capacity measured by the force it can exert when tethered to a bollard.
Force Multiplication Factor:	The factor applied to the towline force to determine the force transmitted through a fairlead or chock due to the wrap angle of the towline through the fairlead or chock.
Indirect active escort:	The use of hydrodynamic forces generated by the water flow in relation to the aspect of the tug's hull to generate increased steering and stopping forces.
Indirect towing forces:	The increase in force applied to a towed vessel beyond the static bollard pull of the tug, e.g. these forces are determined by the incidence angle between the water flow and the underwater hull of the tug. Higher speeds and acute incidence angles produce greater indirect towing forces.
Minimum breaking load:	The minimum load that would cause a towing line to fail or break.
Normal towing:	The standard method of towing, where a tug connects to the ship being towed and exerts forces through the towline aligned with the static bollard pull of the tug.
Rate of Turn:	The rate at which a vessel changes its heading or direction while navigating.
Snatch load:	The additional increase in force due to the towline slackening then tensioning very quickly, usually due to sea state.
Under keel clearance:	The distance between the lowest point of a ship's hull and the seabed.

Document Information

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