West of England

Loss Prevention Bulletin

The Risk of Tugs Capsizing due to Girting

Introduction

Towing operations, by their very nature, can be dangerous if not safely managed and executed. One particular hazard is “girting” which can rapidly lead to the tug or towing vessel capsizing and lives being lost.

Girting

Girting may also be referred to as girthing, tripping or girding. A towline under tension will exert a heeling moment on the tug if the line is secured around amidships and is leading off towards the beam. As with any vessel which heels over due to an external force, a righting lever is formed as the centre of buoyancy moves towards the centre of the tug’s underwater volume, countering the heeling moment and pushing the tug back upright. However, if the force in the towline is sufficiently powerful, it may overcome the tug’s righting lever and cause it to capsize or “girt”. Girting can occur very rapidly and incidents have occurred where crewmembers have not been able to escape in time. Moreover, it should not be assumed that the winch or winch brake will render or that the towline will break before a potential girting situation occurs as less force may be required to capsize the tug.

Tug stability, design and manoeuvring considerations

On a vessel’s curve of statical stability (GZ curve), the point of contraflexure represents the point of deck edge immersion. From this angle of heel onwards, the rate of increase in the righting lever diminishes. Tugs generally have a small freeboard; therefore deck edge immersion will generally occur at a relatively small angle when heeled over. This means that tugs generally have less residual stability when compared with larger vessels or other ship types. The immersion of a tug’s deck edge leads to a reduction in its ability to overcome the external transverse heeling force caused by the towline. Additionally, in cases where tugs have foundered due to girting or being overrun by their tow or being dragged over by their lines when pushing, the doors, hatches, vents and manhole covers on the weather deck have often been left open, allowing water to flood into the tug soon after deck edge immersion and causing a rapid loss of stability.

Some tugs are more at risk of girting than others. This will largely depend on the position on deck where the towline leads away from the tug (longitudinally, vertically and transversely) and the location of the tug’s propulsion system. A towline which leaves a tow hook, H frame or winch high above the deck, close to amidships and off the centreline will make a tug more susceptible to girting compared with one where the towline passes through a lead situated low down on the weather deck, on the fore and aft centreline close to the stem or stern. Therefore a conventional tug, anchor handling tug (AHT) or anchor handling tug supply (AHTS) vessel with stern propellers and a tow hook, winch or H frame situated amidships will be more exposed to girting than, for example, a tug equipped with a Voith Schneider or azimuth stern drive propulsion system and a towing point at the opposite end.

This makes the position where the towline leaves the tug of critical importance. The higher the location, the greater the lever and heeling moment exerted on the tug. If offset to one side, for example a towline which leads from one end of a towing H frame, the heeling moment acting on the tug will be to one side of the centreline towards the direction of pull, increasing the magnitude of the heeling moment. Ideally, the longitudinal position where the towline leaves a tug should be well clear of amidships so that any tension in the towline minimises the heeling moment and increases the turning moment, rotating the hull around its pivot point. However, there is a conflict when it comes to positioning the towline longitudinally. In order for a tug to manoeuvre easily when the towline is under tension, it is desirable to locate it close to the pivot point which will generally be nearer amidships on a conventional tug with propellers aft. Such an arrangement means that any turning moment caused by the towline will be reduced and easily overcome by the turning moment produced by the tug’s propulsion system. However, this also increases the possibility of girting.

Conventional tugs and towing vessels are at greater risk of girting

Potentially hazardous towing operations

If a conventional tug is acting as a bow tug and is overtaken by its tow at speed, manoeuvring control may be lost due to the drag force of the water flow on the tug's underwater hull. Coupled with the heeling effect of the towline, this may lead to a situation where girting is possible.

If a conventional tug is acting as a stern tug and is moving astern, a heeling moment will be caused by the towline if the centreline of the tug and the direction of the tow become misaligned, exacerbated by the drag force of the water flow on the tug's underwater hull. In such circumstances the force in the towline may exceed the tug's bollard pull. Again, such circumstances may result in girting.

In both of these situations the drag force caused by the flow of water on the hull may make it difficult for the tug to realign itself with the towline and tow. Loss of steerage is a warning sign that immediate action is required to prevent the tug from being girted.

Minimising the risk of girting

Modern tugs are normally fitted with a substantial towline lead either at the bow or near the stern to minimise the likelihood of girting. Older conventional towing vessels generally have a towing hook, H Frame or winch mounted at or near amidships, and AHTS vessels by design have their towing winches located forward of amidships in order to maximise the deck area for cargo and anchor handling operations. Although a towing point close to amidships may be advantageous in terms of manoeuvring, this also heightens the possibility of girting. To reduce the risk, various rigging arrangements, fixtures and fittings are available to direct the towline so that it leaves the vessels towards the stern. Some of these arrangements also permit free movement of the towline to minimise the effect on manoeuvrability.

Some of the measures used to lead a towline away from amidships and nearer the stern are considered below. These need to be effected prior to commencing towing operations as to do so once the towline is under tension or has been made fast would be hazardous.

- **Fixed gog (or gob):** Wires or chains, sometimes referred to as a stop rope or bridle rope (not to be confused with the bridle connected to a tow), fitted between a substantial pad-eye or connection on the centreline towards the aft end of the main deck and attached to the towline by a wide bodied shackle or a suitable sheave. Such an arrangement can limit the transverse movement of the towline away from the centreline and reduce the risk of girting. The total length of the arrangement should not exceed half the distance between the bulwarks or crash rails, as applicable. If a central securing point is not available, then gog wires may be secured to suitable padeyes on either side of the main deck aft and connected to the towline to limit its transverse movement.

A fixed gog arrangement

A towing pod on an ocean going tug

- **Running gog (or gob):** An adjustable gog wire may provide the best flexibility when towing. Leading from a separate winch drum, the wire is fed through a suitable sheave or wide bodied shackle fitted to a substantial pad-eye or connection on the centreline at the aft end of the main deck, and connected to the towline by a wide bodied shackle or a suitable sheave. This arrangement can be adjusted to allow the tow line to leave the vessel from a position close to the tug's pivot point to aid manoeuvring, it may also be heaved

towards the stern when necessary to prevent high transverse heeling moments. However, care must be exercised when using an adjustable gog wire as it cannot be heaved in once the towline is under tension. AHTS vessels normally use a fixed gog and a running gog when towing.

- **Towing pods:** Fixed structures fitted to the main deck to hold the towline on the centreline towards the stern of the vessel. Usually found on ocean-going tugs.
- **Karmoy Roller:** A heavy duty sheave fitted in a frame, through which the towline is led, which is shackled to a substantial pad-eye or connection on the centreline towards the aft end of the main deck. Normally found on AHTS vessels.
- **Towing pins:** Powered, remotely controlled, retractable vertical rollers, often with locking tops, used to limit the transverse movement of a towline close to the stern. May be fitted as a single pair of pins or as two pairs.
- **Norman pins or stop pins:** Solid vertical metal posts or rollers either at the stern or on each quarter designed to prevent the towline moving away from the stern. These may be remotely controlled, retractable powered pins or fitted manually.
- **Tow Stops:** Solid steel structures designed to prevent the forward movement of towlines over crash rails on AHTS vessels.

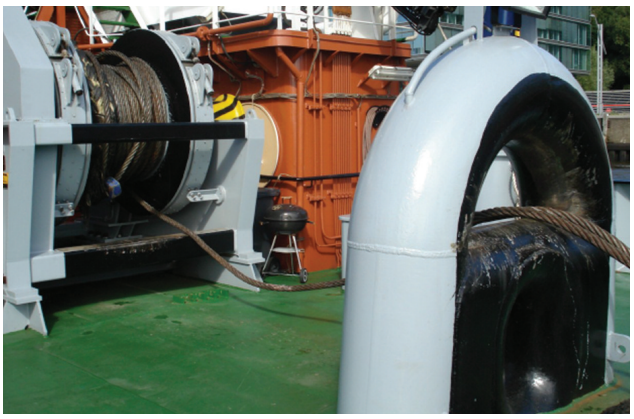
Towline emergency quick release mechanisms

In the event of difficulties due to excessive tension in the towline, activating the towline emergency quick release should be considered. Depending on the arrangement, this may trip the towing hook, release the winch brake or allow the towing winch to freewheel, each of which will release the tension in the towline and allow the tug to return upright and regain control. Numerous types and designs are in use as there are no international standards for quick release arrangements.

Towing hooks should be fitted with a slip arrangement, operable from the bridge, preferably situated next to each manoeuvring station and be capable of being activated regardless of the angle of heel, direction of the towline or tension in the hook. Winches should be provided with an emergency release mechanism which can be triggered in all operational modes from each winch control station. Towline emergency release mechanisms may be hydraulically, pneumatically or mechanically operated but must still function in the event of a blackout.

When activated, the release may not be instantaneous and it may take several seconds before a tow hook trips or the tension in the towline starts to be released, particularly in the case of a winch fitted with a brake band which self-tensions under load. Crewmembers who may be required to use the

Towing pins on the aft bulwark of an ocean going tug



Heavy duty tow wire lead near the stern on a harbour tug fitted with 3 azimuthing propellers in Kort Nozzles; 2 forward and 1 aft

system must be familiar with how the quick release mechanisms fitted to their vessel work including any valves on hydraulic or pneumatic systems that may need to be open to enable the system to operate, and any peculiarities regarding the quick release system including how long it may take to trip a hook or release tension in a winch wire. Any locking pins fitted to release levers should be removed when commencing towing operations.

The tow hook and winch emergency quick release mechanisms should be tested periodically as part of a tug's planned maintenance system, ideally every month. The releases should be tested whilst under load if safe and practicable to do so. In a recent case, a small tug was overrun by the barge it was towing and capsized. The barge was also being pushed from astern. It was subsequently found that although the towing hook pneumatic quick release pins were well greased and the release pins worked as designed when activated, it was not possible for the tow hook to trip with no load as the pivot pin was heavily painted and obstructed by a build-up of debris between the hook and its supporting cheek plates. Even when metal levers were applied to the hook it still failed to move.

If a towline is manually laid-up or if an eye is placed on towing bitts or H frame, it will be almost impossible to release the towline quickly in an emergency. Consequently this method of connecting a towline is not recommended.

Additional Considerations

If a tug or a towing vessel is being pulled to one side, turning to align the centreline of the tug with the towline will cause it to heel towards the towline, initially increasing the angle of heel.

A loss of situational awareness regarding the position of the tow and the angle of the towline to the tug's fore and aft centreline can be dangerous. Being overtaken by the tow can be equally hazardous, and such an incident recently claimed three lives. The tug was made fast to the bow of a vessel which was proceeding along a river in thick fog. The tug is believed to have grounded and was rapidly overtaken by the vessel it was towing. Although the towline quick release was activated, the tension and angle of the towline girted the tug which capsized before the line was able to break free.

A towing vessel's Safety Management System should contain comprehensive procedures regarding towing operations. Harbour Authority requirements should be included, particularly the use of tugs in restricted visibility and minimum visibility criteria.

Some manufacturers have developed automatic towing release hooks. Other systems to minimise the risk of a tug being girted include the Dynamic Oval Towing System where the towing point moves on an oval rail fitted around the outside of the tug's superstructure.

Recommendations

The set-up and use of emergency tow quick release equipment, as well as all additional measures to control the towline to mitigate the possibility of the tug being girted should be addressed in the Safety Management System.

When engaged in towing operations, all weathertight doors, hatches, manholes, ports and windows on the weather deck should be closed and secured to prevent down flooding in the event of deck edge immersion. A check to ensure that such arrangements are closed should be included in a pre-towing checklist. They should also be easily identifiable, for example by painting doors and hatches a different colour or with a contrasting coloured border, and marked with a suitable warning on both sides saying, for example, "To Remain Closed While Towing". Should a situation arise where tension in the towline causes the tug to heel over and the deck edge to be immersed, the delay in down flooding afforded by having watertight integrity on the weather deck may be vital in providing sufficient time for the quick release mechanism to be activated, for the tug to be manoeuvred to lessen the tension in the towline and for personnel to escape to deck from inside the engine room and accommodation.

Watertight and weathertight doors, hatches, vents, windows, ports, side scuttles, all associated seals and securing devices and the automatic closing devices on ventilators should be included in the vessel's planned maintenance system and be inspected and tested regularly.

Operating a tug at or near to maximum power may leave nothing in reserve if a manoeuvring situation starts to become critical. As far as practicable, towing vessels should always be operated so as to leave sufficient reserve power available for emergencies or in case of need. A tug's bollard pull should always comfortably exceed that required for a particular operation.

In a number of recent cases where two or more tugs were involved in a towing operation, excess speed played a part in the rapid development of deteriorating conditions. A suitable maximum speed for the operation should be determined and agreed by all parties beforehand as part of a comprehensive planning process, allowing time for remedial action to be taken if one of the tugs gets into difficulties. The higher the speed of the tow, the greater the forces imparted in the towlines and the less time available to take action if things start to go wrong.

If steering problems are experienced while towing, this is generally a significant concern. In such circumstances immediate action must be taken to reduce the speed of the tow and it may be necessary to release the towline to prevent the possibility of girting.

If towing arrangements are modified, for example, by fitting a new towing point or an additional winch, the effect on stability during a towing operation should be considered and checked by the tug's Classification society before use.

A comprehensive pre-tow checklist should be included in a vessel's Safety Management System and be completed prior to each towage operation to ensure that everything is prepared and functioning correctly. Such checks should include the closing and securing of all openings on the weather deck, maximum towing speeds/power settings and towline control arrangements. The British Tugowners Association has produced a Pre-Towing Tasks Checklist which, although aimed at harbour towage tasks, itemises many checks which are equally applicable to long distance and offshore towage operations.

Members requiring any further guidance should contact the Loss Prevention department.

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