

Deck Machinery

DESIGN AND QUALITY

By Barry Griffin

Why is it always the winch brakes that fail in the movies, sometimes followed by the even more dramatic winch drum and frame flying off the deck into the stormy night? Was it lack of maintenance? Poor design or materials? Low bid? Improper shipyard installation? Wrong winch for the job? Too small? Too light? . Loss of power in the engine room? Operator error? Rigging failure at the payload?

We are lucky that these events seldom if ever occur in real life. Yet when they do, even if minor in consequence, the “body of mistakes and near misses” grows. This is one reason why many commercial customers rely on the several winch builders that have been around a while and have direct experience in the kind of operation being considered. In the case of Markey, for example, which was founded in 1907, the company recently completed its 18,385th marine equipment job.

Despite the odds and surface appearances, a well designed and properly used and maintained commercial winch can give 30 or more years of service.

In many cases, the machinery and deck arrangement can be upgraded to deploy modern synthetic lines - such as the recent conversion of the 730 foot *SS Chesapeake* MARAD tanker to a 4 point synthetic PLASMA mooring.

The normally conservative body of knowledge is helpful, but not always appropriate when applying new technologies to new vessels and new ways of operating. Competition among vessel operators has created

the need for ever more sophisticated and cost effective deck machinery. Lower manpower, reduced maintenance, more operator friendly features, and lower installation and operating costs are the requirements. The comparison between a modern winch-hawser system and a ship working lines by hand is striking.

An Old Story

The see-saw marriage between innovation and tradition is not new in the deck machinery business. For example, a Markey press release from the early 1950's highlights the “largest electric towing winch ever built on the West Coast” for an Oahu Railroad tug. 50 years later the process repeats itself at Marco shipyard, where Crowley's new North Sound Escort Tug has been fitted with a Markey “drop in”, 250 hp all electric programmable Hawser winch.

Government and Commercial regulations are playing an increasing role in deck machinery design and manufacture. ABS classing of chain windlasses and mooring systems is now commonplace. The winch manu-

facturer is required to submit detailed drawings for review and certification. In addition, the Oil Companies International Marine Forum (OCIMF) has developed operational and design standards for both syn-

thetic and wire mooring machinery onboard oil carrying ships and barges. These regulations, when combined with Coast Guard , and IEEE-45 standards, have gone a long way toward giving vessel operators some assurance of quality and operational uniformity. Crowley's latest series of ATBs, for West Coast operation, employ these standards, including the development of OCIMF rated mooring machinery and



Maintenance, or lack thereof, plays an important role in the operation of deck machinery.

fittings specifically designed for use with a new generation of high-performance softlines.

Quality in a winch is often directly related to the value of the object at the end of the wire or hawser and the consequence of winch failure - a \$20,000 cod-end, a million dollar oceanographic package, a Captain's job and retirement , or a

\$20 million plus dollar tankbarge on the rocks, plus cleanup. In one sense most of us in the winch business are the middlemen between the skilled designer-machinist-welder and the men doing the very hard and dangerous work on deck.

Basic Winch Performance

A well done and complete drum chart is a good way to understand winch performance and efficiency. The following is a drum chart for a 2" wire towing winch on the Phyliss Dunlap. (See chart on page 30)

This chart shows the length of material on every layer, and the maximum speed and pull possible on that layer. Notice that the maximum speed and pull changes inversely as the line is payed out or recovered. Because the speed (RPM) and torque (twisting power) of the drum are determined and limited by the power available, the maximum line pull will increase as the layers payout, and the maximum speed will increase as the line is hauled back. Imagine what would happen if the diameter of the rear tires of your car got smaller every 100 feet in forward, and bigger in reverse. In the case of a chain windlass, the design speed and pull remains basically constant, as chain is typically lifted by a fixed diameter chain wheel (wildcat).

The chart contains constants determined from experience with several different power systems and methods of turning that power into useful work. The overall mechanical efficiency (losses from friction, resistance, turbulence, plumbing, etc.) of converting ship's power from a diesel genset or auxiliary through the winch and into the payload can vary as much as 15% losses for electric drives to 50% for hydraulic drives.

The drum chart illustrates perhaps the most efficient system - the direct drive diesel tow winch - which is the common preferred overall choice, especially for high pull, rugged offshore towing service.

Efficiency

The more modern electric winches usually require an equally efficient gearbox and variable frequency drive to control the speed and pull of the winch drum. For example, it is possible to hand turn the shafts of the Markey 3 speed automatic gear box



Wynewma Spirit's Markey winch, seen through the staple.

for the new Vessel Management Services North Sound tug before final assembly. To match the performance of this electric drive and gear box would require at least 5 medium pres-



A Markey 40 hp hydraulic power unit delivers about 28 to 30 useful horsepower to the hawser.

sure hydraulic motors, arranged radially around the winch drum, or 2 or 3 low pressure drum motors, with multiple high flow hydraulic valves, plumbing and control circuits. All the captain in the pilothouse knows is that the control joystick allows a full range from 490,000 lbs of line pull (3 times bollard pull), continu-

ously or in auto-tension mode, to 700 feet per minute of payout speed (7 knots) at light line loads, if required.

Hydraulics will always have a place where lower power efficiency, and higher installation and maintenance costs are a minor concern. On the plus side, simple hydraulic winches offer compact, and relatively inexpensive drive and control systems. The machines are usually easy to repair (bring a bucket and lots of rags). I will never forget struggling down the 1/2 mile long icy pier at Larsen Bay, on Kodiak, in the early 1980's, with all my electrical tools, meters, oscilloscope, spare circuit boards, soldering iron, etc., while Curly Weinbrenner was whistling along with his bowling bag containing only his hydraulic pressure gauge and a change of socks.

Noise

Noise is always a factor on a boat with a crew down - and the first thing I learned when visiting on boats was to speak softly and not slam the door to the head. But noise and machinery go hand in hand. When I first went to sea on trawlers, the noise of the hydraulics coming on was the alarm clock that got you out on deck when it was time to haul back. On a 4 or 6 man tractor tug the quieter the machinery is, the better. This is one reason electric winches have been gaining popularity for this type of vessel. The electric drives have a characteristic faint high-pitched hum that is much easier to block than even the most quiet hydraulic system.

Efficiency is also a factor in genset selection, which usually ranges from 65Kw to 120 Kw for common applications with vessels in the 90 to 150 ft range with 3000 to 8000 hp propulsion. The intermittent winch loads are often much higher than the routine hotel loads for most of these commercial vessels (excluding fishing refrigeration systems). Therefore a smaller genset driving the more efficient electric winch system will often allow equal performance, and higher (better) genset loading, than an equivalent hydraulic system.

Deck Layout

Putting the winch and handling system onto the deck is the final piece of winch design. The locations are important for safety and ease of use.

Feature: Deck Machinery

1st Gear Performance & Drum Capacity

11	68.00	18	285	2212	110,923	99,182	19	32,941	238	194,716
10	64.00	17	268	1927	117,856	105,381	18	35,000	224	206,886
9	60.00	16	251	1659	125,713	112,406	17	37,333	210	220,678
8	56.00	15	235	1407	134,692	120,435	16	40,000	196	236,441
7	52.00	14	218	1173	145,053	129,699	15	43,077	182	254,629
6	48.00	13	201	955	157,141	140,508	14	46,667	168	275,848
5	44.00	12	184	754	171,426	153,281	13	50,909	154	300,925
4	40.00	10	168	570	188,569	168,609	11	56,000	140	331,017
3	36.00	9	151	402	209,521	187,343	10	62,222	126	367,797
2	32.00	8	134	251	235,711	210,761	9	70,000	112	413,772
1	28.00	7	117	117	269,384	240,870	8	80,000	98	472,882
Layer #	Pitch Dia Inches	Ft/wrap	Ft/layer	Drum Cap. Feet	Linepull Lbs. Stall	Linepull Lbs. 90% Stall	Linespeed Ft/Min.	Linepull Lbs. Light Line	Linespeed Ft/Min.	Brake Cap. Lbs.

A drum chart shows how the performance of a winch changes in relation to the amount of line in use.

MARKEY TOWING WINCH

Type TDSD-34 PORT DRUM

Barrel Diameter 26 Inches

Barrel Width 35 Inches

Flange Diameter 70 Inches

Wraps, actual 16 Per Layer

Wire Diameter 2.00 Inches

1st GEAR

Pull @ barrel 80,000 Lbs

FPM @ barrel 98 Ft/Min

Stall Pull @ barrel 269,384 Lbs

90% Stall 8 Ft/Min

2nd GEAR

Pull @ barrel 38,600 Lbs

FPM @ barrel 160 Ft/Min

Stall Pull @ barrel 132,380 Lbs

90% Stall 17 Ft/Min

Drum Capacity 2,200 Feet

Nominal Wraps @ 7.5% 16.28 Per Layer

Air Gap 9.38 %

Tug Horsepower 5,000 hp

Bollard Pull 100,000 Lbs

Winch Power Caterpillar
3306

Torque Converter Twin-Disc
8FW 1801

Stall Ratio (Nominal) 2.7

Transmission Twin-Disc
TAC-33-1601

Barry Griffin is a Harvard graduate with more than 20 years of engineering and sales experience in the marine equipment business. Since 1992 he has logged more than 850 ship-days observing winch and vessel operations specializing in high performance winch and rope systems as a manufacturer's representative for Markey Machinery Company, Puget Sound Ropes, Schoellhorn-Albrecht, Ocean Spar Technology, and PERKO Commercial.