USCG 46CFR189.35 vs Commercial Standards for deck machinery : A comparison of their impact on design and load testing

16 October 2018

Presented by:

Michael T. Einhorn P.E.

Einhorn Engineering, PLLC

EINHORN ENGINEERING PLLC

22 Pages Today

The Boston Post

EXTR

TWENTY-TWO PAGES—TWO CENTS — Established 1831 — THURSDAY, JANUARY 16, 1919 ** — Copyrighted 1919, by Post Publishing Co. — TWENTY-TWO PAGES—

HUGE MOLASSES TANK EXPLODES IN NORTH END; 11 DEAD, 50 HUR

Giant Wave of 2,300,000 Gallons of Molasses, 50 Feet High, Swe Everything Before It—100 Men, Women and Children Caught in Sticky Stream—Buildings, Vehicles and L Structure Crushed

35 STATES ON DRY LAW LIST

Amendment Ratified by Five Yesterday—One More Needed—Predict Nation Dry July 1

WASHINGTON, Jan. 15—Legislatures of 35 States—one less than the required three-fourths—have ratified the prohibition constitutional amendment. Several State Assemblies now in session are expected to take action tomorrow, with a probable vote by Nebraska, Missouri and Minnesota, all on which will be the 36th to the list.

Ratification was completed today by the Legislatures of five States—Iowa, Colorado, Oregon, New Hampshire and Nebraska—a total of 32 in two days. Of the 19 States that have taken action, only 14 have certified

SECRECY IN PEACE CONGRESS

France, Italy and Japan Outvote U. S. and

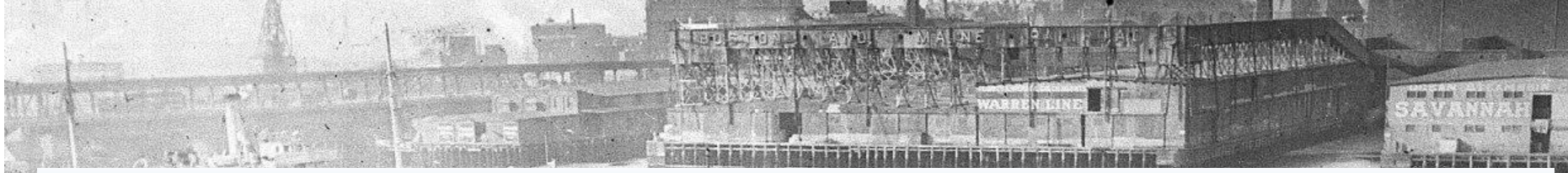
AERIAL VIEW OF THE SCENE OF THE NORTH END TANK BURSTING OVER AND INTO WIDE OF THE PLAYGROUND

Search for M Victims Durin the Night

No Escape Fr Gigantic Wav of Fluid

INTERNAL EXPLOSION WAS CAUSE, SAYS STATE C

It became known last night that W. L. Wedger, chemist in charge of explosives, had reached the conclusion that the disaster instead of being due to a co great tank was caused by an internal explosion. Mr. his investigation is understood to have found that th fitted with heating apparatus that connected with a l heating apparatus consisted of pipes inside the tank



- Designed with insufficient factory of safety

- Shell plating supplied below specified thickness

- Supplied steel lacked the needed ductility

Boston Building Department Requirements Post Disaster

- Drawings and calculations to be signed and filed with the city.
- Licensed architect and engineer oversight

46 CFR Chapter I, Subchapter U
OCEANOGRAPHIC RESEARCH VESSELS

(1) Wet Weight Handling Gear: Wet gear shall be considered to consist of gear used to lower equipment, apparatus or objects beneath the surface of the water or for trailing objects, where the wire rope or cable is payed out beneath the surface and becomes part of the line pull at the head sheave or winch drum. Wet gear shall be designed, as a minimum, to withstand and operate in excess of the breaking strength of the strongest section or wire to be used in any condition of loading. The safety factor for all metal structural parts shall be a minimum of 1.5; i.e., the yield strength of the material shall be at least 1.5 times the calculated stresses resulting from application of a load equal to the nominal breaking strength of the strongest section or wire rope to be used. Suitable

46 CFR 189.35

time of the vessel's inspection periods if a visual examination or review of the equipment record reveals evidence of an unsafe condition. Tests should normally consist of exercising the equipment as a unit with a proof load 25 percent in excess of the equipment's normal working load, however manufacturer's design limitations should not be exceeded. Consideration shall be given to the plans of loading when con-

DOB ~ 1967
2 Pages

EINHORN ENGINEERING PLLC

189.35 in a Nutshell

- DESIGN
  - The maximum design load (i.e. worst case expected load) is the cable breaking strength
  - Design to 2/3 of material yield @ the maximum design load.
- PROOF TESTING
  - Test to 125% of the maximum working load (i.e. Safe Working Load).
  - Possibly recertify at vessel inspection intervals (5 years)

Commercial Design Standards for Over-the-side Handling Equipment

American Petroleum Institute

Specification for Offshore Pedestal Mounted Cranes

DNV

Standard for Offshore and Platform Lifting Appliances

ABS FOUNDED 1862

Rules for Building and Classing Underwater Vehicles, Systems, and Hyperbaric Facilities

EINHORN ENGINEERING PLLC

Approach of the ABS Standard

- DESIGN
  - Determine maximum design load (i.e. worst case expected load)
    - Ship dynamics
    - Payload drag
    - Entrained mud
  - Allowable stress design @ the maximum design load.
- PROOF TESTING
  - Static load test to the maximum design load
  - Functional load test to 125% of SWL
  - Recertify at 3 year intervals

Example for Comparison

- A-frame handling equipment
- Specified for a 30kip rated capacity
- Used with a maximum of 1” wire with a UBS of 120kip
- Designed to be used up to low SS 6.

Table 3 **A-Frame (at Sheave) Maximum Accelerations, 45° Outboard Position, H_s = 13.12 ft, Statistical Extreme**

Departure Load (with Ice)	Acceleration A-Frame (Sheave) g	Heading deg	Speed kts	T_{modal} sec
Longitudinal Acceleration	0.126	30	8	9.8
Lateral Acceleration	0.275	75	8	9.8
Vertical Acceleration	0.664	45	8	9.8

USCG 46CFR189.35 as a Design Standard: Considerations for Extreme Loads and Load Testing

16 October 2018

Presented by:

Michael T. Einhorn P.E.

Einhorn Engineering, PLLC

EINHORN ENGINEERING PLLC

CFR Worked Example

- Maximum working load = 30 kips
- Design Load = 120 kips
- Proof test load = 37.5 kips
- Functional test load = 37.5 kips

EINHORN ENGINEERING PLLC

ABS Worked Example

- Rated Capacity= 30 kips
- Design Load = 57 kips
  - Dynamics = 30*1.664=50 kips
  - Ice loading = 5 kips
  - Entrained mud/soil = 2 kips
- Proof test load = 57 kips
- Functional test load = 37.5 kips

Commercial Crane Specifications

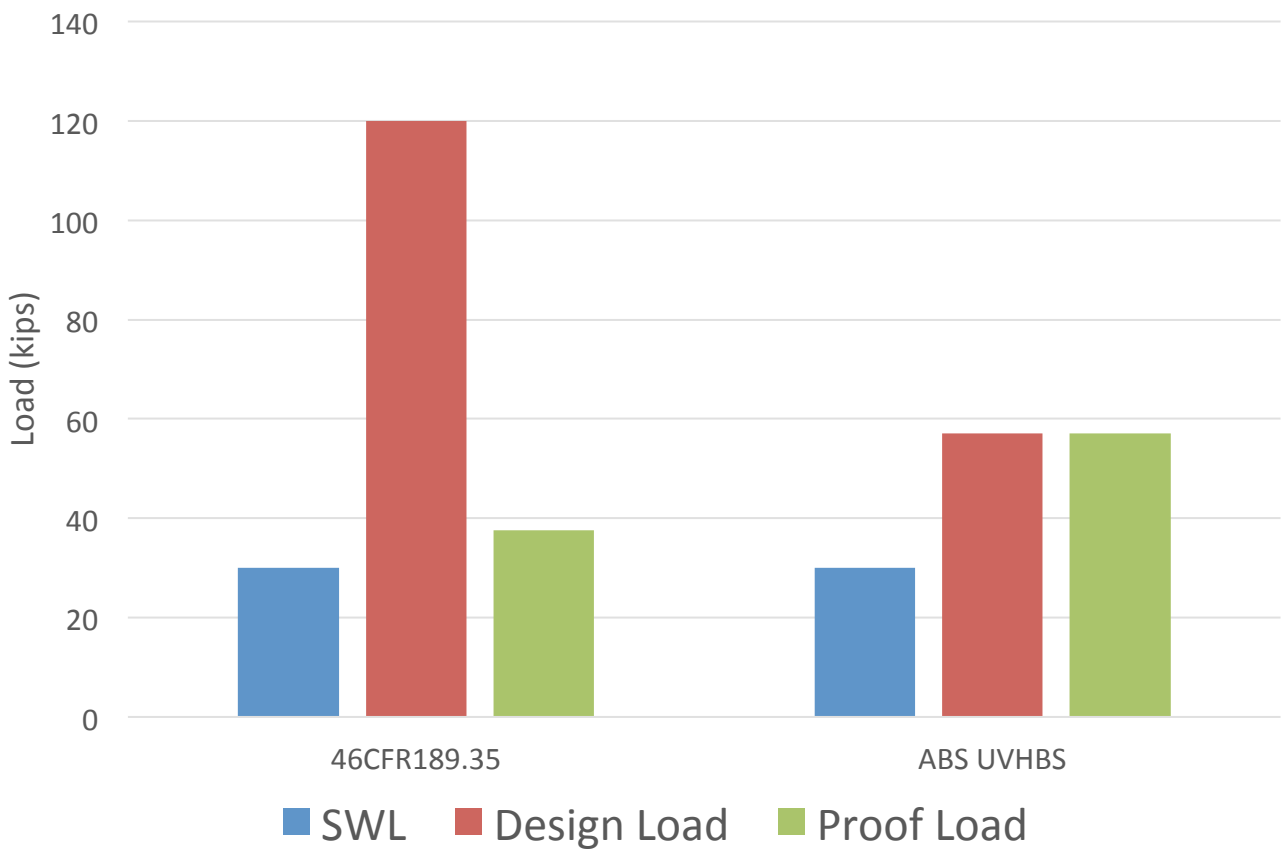
API – Specification for Offshore Pedestal Mounted Cranes

4.6 GROSS OVERLOAD CONDITIONS

In the case of a gross overload condition, due to the crane hooking a supply boat or other unforeseen event, the crane may fail catastrophically up to and including the possible separation of the entire crane and operator from the foundation. The allowable unit stresses and design factors used in this specification to establish safe working loads for normal conditions do not prevent such a failure in the event of such a gross overload.

EINHORN ENGINEERING PLLC

CFR vs ABS
SWL & Test Load Comparison

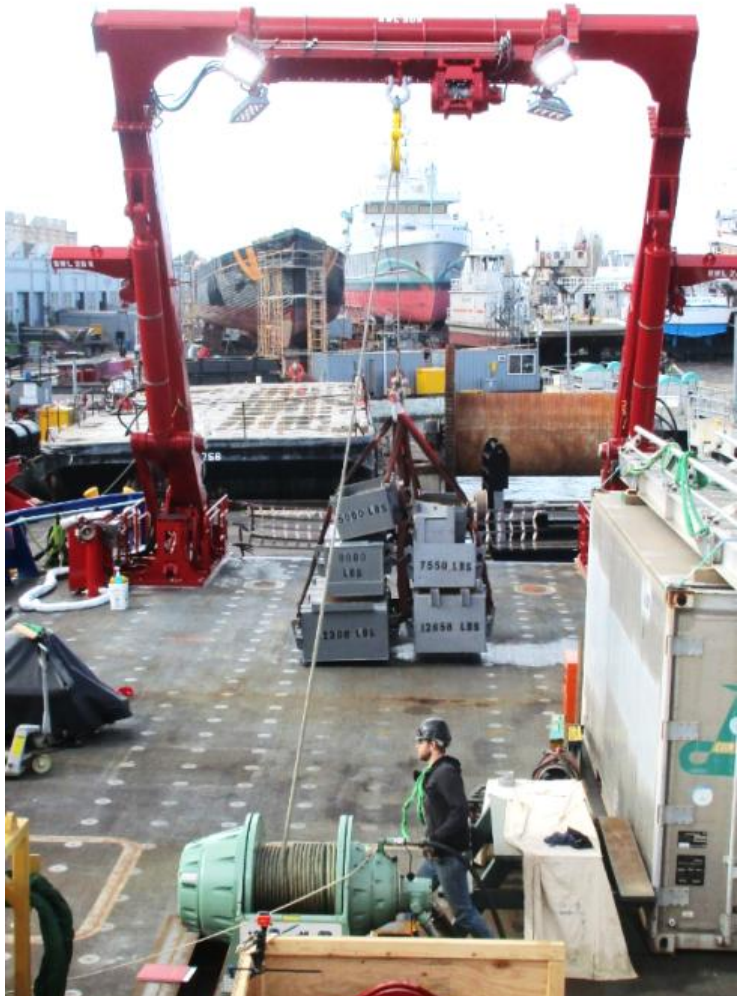


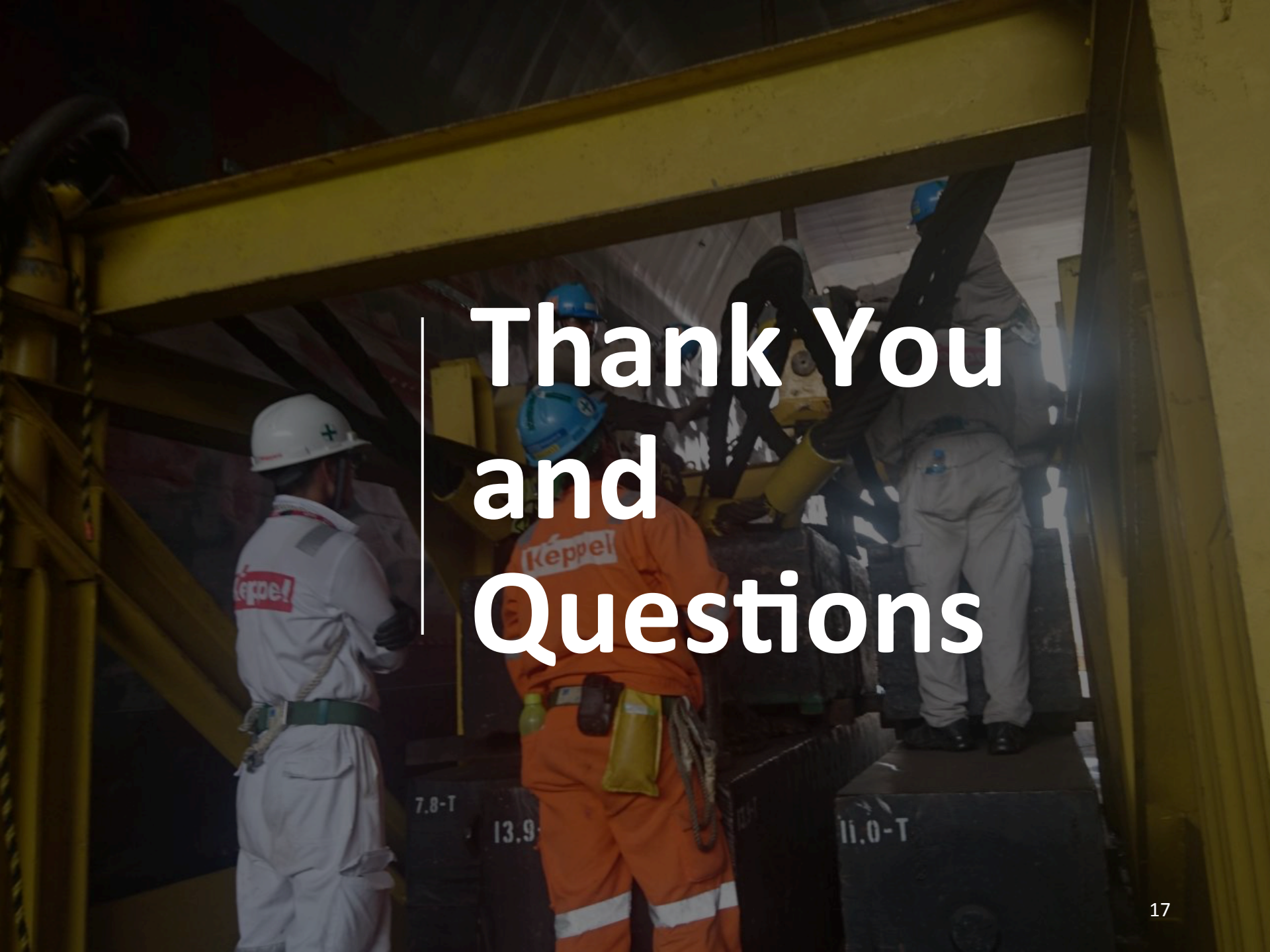
EINHORN ENGINEERING PLLC

For Future Consideration….

- While the CFR provides the safest design approach, does the 51 year old regulation still provide adequate proof load testing?

- Proof load testing should exceed all anticipated real world loads.





Thank You and Questions