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Longshoring and Marine Terminals; Vertical Tandem Lifts; Final Rule

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Parts 1917 and 1918

[Docket No. S–025A]

RIN 1218–AA56

Longshoring and Marine Terminals; Vertical Tandem Lifts

AGENCY: Occupational Safety and Health Administration (OSHA), Labor.

ACTION: Final rule.

SUMMARY: OSHA is revising the Marine Terminals Standard and related sections of the Longshoring Standard to adopt new requirements related to the practice of lifting two intermodal containers together, one on top of the other, connected by semiautomatic twistlocks (SATLs). This practice is known as a vertical tandem lift (VTL). The final standard adopted today permits VTLs of no more than two empty containers provided certain safeguards are followed.

DATES: This final rule becomes effective on April 9, 2009.

ADDRESSES: In accordance with 28 U.S.C. 2112(a)(2), the Agency designates Joseph M. Woodward, Associate Solicitor of Labor for Occupational Safety and Health, Office of the Solicitor, Room S–4004, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210, to receive petitions for review of the final rule.

FOR FURTHER INFORMATION CONTACT: For technical inquiries, contact Joseph V. Daddura, Director, Office of Maritime, Directorate of Standards and Guidance, OSHA, U.S. Department of Labor, Room N–3621, 200 Constitution Avenue, NW., Washington, DC 20210; telephone: (202) 693–2222. For general information and press inquiries, contact Jennifer Ashley, Director, Office of Communications, OSHA, U.S. Department of Labor, Room N–3647, 200 Constitution Avenue, NW., Washington, DC 20210; telephone: (202) 693–1999. For additional copies of this **Federal Register** notice, contact OSHA, Office of Publications, U.S. Department of Labor, Room N–3101, 200 Constitution Avenue, NW., Washington, DC 20210; telephone (202) 693–1888. Electronic copies of this **Federal Register** notice, as well as news releases and other relevant documents, are available at OSHA's Web page on the Internet at *http://www.osha.gov.*

SUPPLEMENTARY INFORMATION: This preamble to the final rule for VTLs in the Longshoring and Marine Terminals Standards discusses the events leading to the adoption of the standard, the necessity for the standard, and the rationale behind the specific provisions set forth in the final rule. The preamble also includes the Final Economic and Regulatory Flexibility Analysis, a summary of the paperwork issues under the Paperwork Reduction Act of 1995, and sections on other requirements necessary for an OSHA standard. The discussion follows this outline:

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I. Background

A. Acronyms and Abbreviations

The following acronyms and abbreviations have been used in this document:

1998–Tr. Transcript page number from the public meeting on VTLs in January 1998
ACEP Approved Continuous Examination Program
DOL Department of Labor
Ex. Exhibit
FEA Final Economic Analysis
ICHCA International Cargo Handling and Coordination Association
ILA International Longshoremen's Association
ILO International Labor Organization
ISO International Organization for Standardization
ISO/TC 104 ISO Technical Committee Number 104 Freight Containers
ILWU International Longshore and Warehouse Union
NEPA National Environmental Policy Act
MACOSH Maritime Advisory Committee for Occupational Safety and Health
NIOSH National Institute for Occupational Safety and Health
NIST National Institute of Standards and Technology
NMSA National Maritime Safety Association
NPRM Notice of Proposed Rulemaking
OMB Office of Management and Budget
OSHA Occupational Safety and Health Administration
PCMSC Pacific Coast Maritime Safety Code
PMA Pacific Maritime Association
RFA Regulatory Flexibility Act
SNTRI Swedish National Testing and Research Institute
Tr. Transcript page number from the public hearing held on July 29 (Tr. 1-page) and July 30 (Tr. 2-page), 2004
SATL Semiautomatic twistlock
TEU 20-foot equivalent unit
UMRA Unfunded Mandates Reform Act of 1995
USMX United States Maritime Alliance
VTL Vertical tandem lift

B. Introduction

Since the 1970s, intermodalism (the containerization of cargo) has become the dominant mode of cargo transport in the maritime industry, replacing centuries-old, break-bulk cargo handling. In the marine cargo handling industry, intermodalism typically involves three key components: standardized containers with uniform corner castings; interbox connectors (such as SATLs) to secure the containers (to each other at the four corners, to the deck of the ship, to a railroad car, or to a truck chassis); and a type of crane called a container gantry crane that has specialized features for the rapid loading and unloading of containers. Because intermodalism is highly dependent on standardized containers and connecting gear, several international organizations have developed standards for equipment and practices to facilitate intermodal freight operations. This helps ensure that containers and interbox connectors are sized and operate properly so that containers and connectors from different manufacturers will fit together.

The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies whose mission is to promote the development of international standards to reduce technical barriers to trade. There are several ISO standards addressing the design and operational handling of intermodal containers and interbox connectors. In particular, ISO 3874, *Series 1 Freight Containers—Handling and Securing,* addresses the size and strength of containers and corner castings, the size and strength of the interbox connectors, and proper lifting techniques. During shipment, containers above deck are secured by interbox connectors to each other and to the deck of the ship. In the conventional loading and unloading process, the container gantry crane lifts one container (either 6.1 or 12.2 meters long) at a time, using the crane's specially developed spreader beam. ISO 3874 also addresses the lifting of two 12.2-meter containers end to end but, until 2003, it had not addressed the practice of VTLs. A VTL is the practice of a container crane lifting two or more intermodal containers, one on top of the other, connected by a particular type of interbox connector known as a semi-automatic twistlock or SATL.

The VTL issue has been evolving for many years. The following table shows the progression of events:

1986	Matson Terminals, Inc., requests permission to perform VTLs, and OSHA responds with letter allowing VTLs with two empty containers or with automobiles.
1993	OSHA issues a letter to Sea-Land Service, Inc., allowing VTLs with two empty containers under certain conditions.
1994	OSHA publishes a proposed rule to revise the Marine Terminals and Longshoring Standards.
1997	OSHA publishes the final rule revising the Marine Terminal and Longshoring Standards, reserving the VTL issue for future consideration.
	OSHA reopens the VTL record and announces a public meeting on the safety, risk, and feasibility issues associated with VTLs.
1998	OSHA holds the public meeting on the safety, risk, and feasibility issues associated with VTLs.
2003	OSHA publishes a proposed rule permitting VTLs of no more than two containers with a maximum load of 20 tons.
2004	OSHA holds a public hearing on the proposed rule on VTLs.

The issue of vertical tandem lifting was first raised to OSHA by Matson Terminals, Inc. In 1986, through a series of meetings and correspondence with OSHA (Exs.[1] 40–1, 40–2, 40–3, 40–4, 40–5, 40–6, 40–6–1, 40–7), Matson asked to be permitted to lift two containers at a time, connected by SATLs, either empty or with one or both containers containing automobiles. At that time, OSHA regulations did not directly address or prohibit this practice. The container handling regulation formerly in § 1918.85(c) stated, ''all hoisting of containers shall be by means which will safely do so without probable damage to the container, and using the lifting fittings provided.'' [2] In November 1986, OSHA, in a letter to Matson (Ex. 40–8), allowed the company to lift containers, either empty or with one or both containers containing automobiles, in VTLs. The letter to Matson stated:

> The [Compliance Safety and Health Officer] must be mindful of the manufacturer's specifications and endorsements, the Matson engineering technical specifications, the ABS Test Report, as well as, maintained conditions of the corner posts, the twist locks, the cones, the containers and the hoisting and/or lifting devices. [Ex. 40–8]

In 1993, OSHA received a letter from Sea-Land Service, Inc., requesting that OSHA interpret its existing longshoring standards to allow the lifting of two empty 12.2-meter (40-foot) ISO freight containers that were vertically coupled using SATLs (Ex. 1). OSHA's standards had not changed since OSHA's letter to Matson. In its response, OSHA allowed Sea-Land to handle two empty containers vertically connected, if eight requirements were met (Ex. 2, hereinafter called ''the Gurnham letter''). The requirements were developed by OSHA's Directorate of Compliance Programs (now called the Directorate of Enforcement), taking into account applicable OSHA standards and related industry practices associated with container cargo handling operations. These eight requirements were: inspecting containers for visible defects; verifying that both containers are empty; assuring that containers are properly marked; assuring that all the SATLs operate (lock-unlock) in the same manner and have positive, verifiable locking systems; assuring that the load does not exceed the capacity of the crane; assuring that the containers are lifted vertically; having available for inspection manufacturers' documents that verify the capacities of the SATLs and corner castings; and directing employees to stay clear of the lifting area.

In 1994, OSHA addressed VTLs briefly in the preamble to the proposed revisions to the Marine Terminals and Longshoring Standards (29 CFR Parts 1917 and 1918, respectively; 59 FR 28594, June 2, 1994), stating: ''In those situations where one container is used to lift another container, using twistlocks, then the upper container and twist locks become, in effect, a lifting appliance and must be certified as such'' (59 FR 28602, June 2, 1994). OSHA received comments on this issue only from the International Longshore and Warehouse Union (Exs. 4, 5, 6). Although these comments favored the proposed interpretation and requested that the Agency include it as a requirement in the regulatory text, they included no specific information regarding the hazards of VTLs of two containers using SATLs. Sea-Land submitted a detailed six-page comment (Ex. 7) addressing a number of the proposed changes to the Marine Terminals and Longshoring Standards, but did not address VTLs. OSHA received a late, posthearing submission from the International Longshoremen's Association, however, that alerted the Agency to what might be a serious problem with this type of lift, citing several incidents at U.S. ports where failures had occurred (Ex. 8–A). While OSHA did not rely on this letter in issuing the final rule because it was not a timely submission to the record, the letter made OSHA aware of safety concerns that might need to be addressed through supplemental rulemaking. Because of a lack of information on the safety considerations, cost impacts, and productivity effects of VTLs, as well as on the capability of containers and SATLs to withstand such loading, OSHA reserved judgment on the appropriate regulatory approach to this practice, pending further study (62 FR 40142, 40152, July 25, 1997).

Until the publication of the final Longshoring and Marine Terminals Standards in 1997, OSHA viewed the lifting of one container by another container using SATLs as similar to a container spreader picking up a single container using the spreader's twistlocks. Although the terms ''semi-automatic twistlocks'' and ''spreader-bar twistlocks'' appear similar, they refer to two very distinct items. SATLs were designed to connect and secure intermodal containers that are stowed on the deck of a vessel. They are generally made of a cast metal with a surface that has not been finely honed. By contrast, a spreader-bar twistlock is an integral part of a gantry crane's container spreader. It has a similar appearance to a SATL, but is made of forged metal with a machined surface. These twistlocks are typically locked and unlocked with hydraulic power and are used as part of the gantry crane to lift and move containers.

In lifting the bottom container in a VTL, the upper container serves the same role as a container spreader on a gantry crane, and the SATLs perform the same function of holding the bottom container, as do the twistlocks on the container spreader bars.

A gantry crane's container spreader bars are considered a ''lifting appliance,'' according to the International Labor Organization (ILO) Convention 152 Dock Work, portions of which OSHA incorporated or adopted in the Longshoring Standards in 29 CFR Part 1918. The ILO is a specialized, independent agency of the United Nations with a unique tripartite structure of business, labor, and government representatives. Its mandate is to improve working conditions (including safety), create employment, and promote workplace human rights,

[1] Exhibits in Docket 025A on the proposed rule on vertical tandem lifts (68 FR 54298–54318).

[2] Existing § 1918.85(f) addresses the safe lifting of containers.

globally. Under ILO Convention 152, a lifting appliance, including the twistlocks, must be proof-load tested and inspected before initial use and periodically retested and reinspected. However, applying that same requirement to the VTL situation would be much more difficult to accomplish. It would require a specific container (the one being used to lift another container) and four specific SATLs to be tested and inspected as a unit and to remain as a unit for retesting and reinspection. Given the millions of intermodal containers and millions more SATLs used in the maritime cargo handling industry, matching a specific container and four SATLs for VTL use over any length of time is nearly impossible. In view of this impracticality, OSHA sought an interpretation about the matter from the ILO, which is discussed later in this section of the preamble.

On October 9, 1997, OSHA reopened the VTL record with a **Federal Register** notice that also announced a public meeting, which was held in Washington, DC, on January 27, 1998 (62 FR 52671). At that public meeting, OSHA heard testimony from 25 witnesses, representing the U.S. Coast Guard, the ISO, national and international maritime safety associations, container and twistlock manufacturers, ship operators, stevedoring companies, and longshore unions (Ex. 22x).

Shortly after the January public meeting, OSHA decided on a multifaceted approach to resolve the questions raised during the public meeting:

a. Contract with the National Institute of Standards and Technology (NIST) to conduct engineering studies about the strength and durability of container corner castings and SATLs;

b. Meet with the International Cargo Handling and Coordination Association [3] (ICHCA) about international safety aspects of VTLs;

c. Meet with the ILO to clarify the ambiguity in existing interpretations of ILO Convention 152;

d. Monitor the ISO deliberations regarding VTLs; and

e. Form a workgroup within the Maritime Advisory Committee for Occupational Safety and Health (MACOSH) to address issues relating to VTLs and report back to MACOSH.

MACOSH was chartered by the Secretary of Labor to advise OSHA on matters relating to occupational safety and health standards in the maritime industries. MACOSH members include representatives of employers, employees, State safety and health agencies, a designee of the Secretary of Health and Human Services, and other groups affected by maritime standards. During a MACOSH meeting held in Hampton, Virginia, on September 22 and 23, 1998, a VTL workgroup was formed consisting of the MACOSH longshore employer and employee representatives, with participation by many other interested stakeholders. Over the next several years, the VTL workgroup discussed VTL issues at informal working group meetings and during MACOSH meetings.

On September 28, 1998, members of MACOSH's VTL workgroup met with ICHCA in Malmo, Sweden, to discuss the VTL issue. This was followed by a meeting with ILO in Geneva, Switzerland. The discussion with the ILO focused on the issue of determining whether the components of a VTL (the upper intermodal container and the SATLs) are either a ''lifting appliance'' or ''loose gear'' within the meaning of the relevant international standards. On October 21, 1998, an ILO official indicated to OSHA that the ILO considers SATLs used for lifting to be loose gear, and that it considers the upper container to be merely part of the load, rather than loose gear or a lifting appliance (Exs. 31, 32). The significance of this decision is that as loose gear, under ILO Convention 152, SATLs must be tested and inspected before initial use and reinspected on an annual basis, and the containers have no additional inspection requirements. Lifting appliances, on the other hand, must be retested at least once every 5 years. Retesting of a lifting appliance in a VTL would require that a specific container and four specific SATLs used for VTLs be proof-load tested before initial use and every 5 years thereafter. As mentioned previously, this would be almost impossible to do.

During a MACOSH meeting held at the U.S. Merchant Marine Academy, Kings Point, New York, in July 1999, Dr. H.S. Lew of NIST presented a report on the strength of SATLs, latchlocks (a device similar in usage to a SATL, but of a different design), and container corner castings (Ex. 40–10). Dr. Lew's study indicated that the SATLs he tested were very substantial with load capacities ranging from 562 to 802 kN and that the container corner castings were more likely to deform and fail before the SATLs. However, he expressed reservations about the use of latchlocks as interbox connectors. This particular type of interbox connector has a smaller bearing surface in contact with the corner casting. In Dr. Lew's opinion, this makes it more likely that, if the spring-loaded latch does not extend fully inside the container corner casting, it could slip through the hole in the corner casting when under load, such as when lifting another container. Even when the lock of a latchlock was fully extended, the NIST study determined that its surface area was insufficient to safely perform VTLs. In regard to the strength of SATLs, the conclusions of the NIST study were similar to a Swedish study (Ex. 11–6 H) that was conducted in 1997 by the Swedish National Testing and Research Institute. (For an extended discussion of these studies see the discussion of the issue titled ''Strength of the container-connector system'' under section O, Summary and Explanation of the Final Rule, later in this preamble.)

On September 8, 2000, the U.S. delegation to ISO Technical Committee Number 104 Freight Containers (ISO/TC 104) held a meeting in Washington, DC, primarily to discuss the U.S. position on VTLs for the ISO biennial meeting to be held in October. After this meeting, OSHA sent a letter to the Chairman of ISO/TC 104 addressing concerns such as safety factors, the use of latchlocks, and the lack of operational procedures (Ex. 40–11).

At their biennial meeting in Cape Town, South Africa, in October 2000, the ISO/TC 104 agreed that SATLs, which previously were only used for securing containers, could be used to lift containers. However, ISO/TC 104 did not address the question of how to use SATLs safely for such lifting, because ISO does not issue standards for operational procedures. In response to safety concerns in this area, ISO/TC 104 passed a resolution requesting that ICHCA, a member of ISO/TC 104, develop operational guidelines for VTLs. ICHCA agreed to work on such guidelines.

In May 2002, ISO formally adopted language allowing SATLs that meet certain conditions to be used for lifting:

> The vertical coupling of containers that are not specifically designed as in 6.2.4 [ISO 3874] for lifting purposes, using twistlocks or other loose gear, is acceptable if forces of not greater than 75 kN [Footnote 1]) act vertically through each corner fitting, and the twistlocks or other loose gear used are certified [Footnote 2]) for lifting. The twistlocks or other loose gear shall be periodically examined. [Ex. 40–9]

Footnote 1 stated:

[3] ICHCA is an independent, nonpolitical international membership organization established in 1952, whose membership spans some 85 countries and includes corporations, individuals, academic institutions and other organizations involved in, or concerned with, the international transport and cargo handling industry.

The value of 75 kN prescribes the minimum structural capability of the lock/corner fitting combination. The 75 kN value includes an arbitrary constant wind load of 26 kN (corresponding wind speed of 100 km/h), regardless of the size of the containers. As an example, the balance of the 75 kN value equates to two 1 AAA containers with a combined tare of 22 kN and a maximum payload of 27 kN. A practical upper limit of three vertically-coupled containers is also envisaged.

Footnote 2 stated:

The certification process envisaged is to use a safety factor of at least four based on the ultimate strength of the material.

Essentially, this meant that, based on the strength of the SATLs and the containers, the ISO standard would allow VTLs to consist of up to three containers with a total load weight of 20 tons.

In January 2001, as agreed to at the Cape Town meeting, an ICHCA VTL workgroup met in London to begin drafting operational guidelines for VTLs. The ICHCA workgroup finalized their VTL guidelines (Ex. 41) in September 2002 and received final approval by ICHCA's Board of Directors in January 2003. OSHA gave careful consideration to the ICHCA guidelines in the drafting of the proposed and final standards for VTLs.

II. Pertinent Legal Authority

The purpose of the OSH Act is to ''assure so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources'' (29 U.S.C. 651(b)). To achieve this goal, Congress authorized the Secretary of Labor to issue and to enforce occupational safety and health standards. (See 29 U.S.C. 655(a) (authorizing summary adoption of existing consensus and federal standards within two years of the OSH Act's enactment); 655(b) (authorizing promulgation of standards pursuant to notice and comment); and 654(d)(2) (requiring employers to comply with OSHA standards)). A safety or health standard is a standard ''which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment or places of employment'' (29 U.S.C. 652(8)).

A standard is reasonably necessary or appropriate within the meaning of section 3(8) of the OSH Act if it substantially reduces or eliminates significant risk; is economically feasible; is technologically feasible; is cost effective; is consistent with prior Agency action or is a justified departure; is supported by substantial evidence; and is better able to effectuate the Act's purposes than any national consensus standard it supersedes (29 U.S.C. 652). (See 58 FR 16612, 16616 (3/30/1993)).

A standard is technologically feasible if the protective measures it requires already exist, can be brought into existence with available technology, or can be created with technology that can reasonably be expected to be developed. American Textile Mfrs. *Institute* v. *OSHA (ATMI)*, 452 U.S. 490, 513 (1981); *American Iron and Steel Institute* v. *OSHA (AISI)*, 939 F.2d 975, 980 (D.C. Cir 1991).

A standard is economically feasible if industry can absorb or pass on the cost of compliance without threatening its long term profitability or competitive structure. See *ATMI*, 452 U.S. at 530 n. 55; *AISI*, 939 F.2d at 980. A standard is cost effective if the protective measures it requires are the least costly of the available alternatives that achieve the same level of protection. *ATMI*, 453 U.S. at 514 n. 32; *International Union, UAW* v. *OSHA (''LOTO II'')*, 37 F.3d 665, 668 (D.C. Cir. 1994).

Section 6(b)(7) of the OSH Act authorizes OSHA to include among a standard's requirements labeling, monitoring, medical testing and other information gathering and transmittal provisions (29 U.S.C. 655(b)(7)).

All safety standards must be highly protective. (See, 58 FR 16614–16615; *LOTO II*, 37 F.3d at 668.) Finally, whenever practical, standards shall ''be expressed in terms of objective criteria and of the performance desired'' (29 U.S.C. 655(b)(5)).

III. International Aspects

OSHA has developed this final rule in light of international trade considerations. In the Trade Agreements Act of 1979 (''TAA,'' codified at 19 U.S.C. 2501 *et seq.*), the United States implemented the Agreement on Technical Barriers to Trade, negotiated under the General Agreement on Tariffs and Trade. In particular, Congress has indicated that federal agencies may not ''engage in any standards-related activity that creates unnecessary barriers of trade'' (19 U.S.C. 2532). A standard is ''necessary'' in this context:

If the demonstrable purpose of the standards-related activity is to achieve a legitimate domestic objective including, but not limited to, the protection of legitimate health or safety, essential security, environmental, or consumer interests and if such activity does not operate to exclude imported products which fully meet the objectives of such activity.

(19 U.S.C. 2531(b).) The TAA also requires federal agencies to take international standards into account in standards-related activities and to base their standards on the international standards, ''if appropriate'' (19 U.S.C. 2532(2)(A)). However, international standards are not ''appropriate'' if they do not adequately protect ''human health or safety, animal or plant life or health or the environment'' (19 U.S.C. 2532(2)(B)).

Mindful of these international aspects, OSHA has sought to formulate a protective but flexible approach to VTLs in the final rule. As discussed in further detail below, OSHA's requirements for VTLs are consistent with the relevant provisions of ILO Convention 152 and with many of the provisions of the ISO standard and ICHCA guidelines.

Several commentators suggested that deviations from the ICHCA guidelines and ISO standards for VTLs would create unnecessary barriers of trade in violation of the above provisions (Exs. 47–5; 54–2). OSHA does not agree. First, these commenters' positions seem to be premised on the assumption that there is an international consensus about whether to perform VTLs and how they are to be performed. OSHA finds that the record does not support that assumption. While two international bodies have addressed VTLs (ICHCA and the ISO), the ILO refused to adopt provisions allowing VTLs in its Code of Practice (Exs. 47–4, 50–7, 64). Further the record suggests that VTLs are not performed at many ports worldwide. Submissions indicate, without contradiction, that VTLs are not performed in Canada, Tokyo, Rotterdam, Antwerp, and Russia (Tr. 2–285, 2–295; Ex. 62). Maersk stated that it performs VTLs in only 8–10 of its 80 ports of call (Tr. 2–127 to 128). ICHCA's guidelines specifically note that national legislation may prohibit or limit VTLs (Exs. 41, 8.1.1.2 & 8.1.1.5).

Regardless, OSHA does not believe that limiting VTLs to two empty containers creates a ''barrier to trade'' under the TAA. These requirements are applied to vessels regardless of origin and apply to ships arriving from U.S. ports as well as foreign ports. OSHA's regulation does not discriminate, either on its face or in effect, by country of origin or class of shipper. As indicated in the Final Economic Analysis below, the claim that the final rule ''constitutes a barrier of trade seems to be without merit in any economic sense.''

Moreover, even if the regulation did constitute a barrier to trade, it still would not be ''unnecessary'' in the sense of the TAA. As discussed at length in the Summary and Explanation, OSHA has given extensive consideration to the question of the safety of VTLs, and it has determined that the limitations in the final rule are necessary to protect workers from the significant risk of death or injury inherent in the procedure. Thus, in the terms of the TAA, ''the demonstrable purpose'' of the final rule is ''to achieve a legitimate domestic objective including, but not limited to, the protection of legitimate health or safety * * * interests'' (see 19 U.S.C. 2531(b)). Therefore, the final rule complies with the TAA.

OSHA has also given consideration to the relevant international standards in the area, as required by the TAA (see 19 U.S.C. 2532(2)). Articles 21 through 27 of ILO Convention 152 contain international standards for vessel cargo handling gear, which are intended to protect dockworkers. The United States is not a signatory to either this convention or its predecessor, ILO Convention 32. However, it has nonetheless conformed to them through regulations promulgated by the U.S. Coast Guard, regarding inspected U.S. flag vessels, and by OSHA, regarding other vessels (62 FR 40152). In particular, in its latest revisions to its Longshoring Standard, OSHA updated its vessel cargo handling gear certification requirements to conform to Convention 152's requirements (62 FR 40151–54; 29 CFR 1918.11).

VTLs were not used at the time that Convention 152 was drafted, (Tr. 1–207), and as noted above, there was substantial uncertainty about how it applied to this procedure at the time OSHA revised its Longshoring Standard in 1997 (see 62 FR 40152–53). This engendered substantial study of VTLs, both by OSHA and the international community, as detailed elsewhere in this preamble. The result of this study is that, although the ILO has since clarified that twistlocks used in VTLs are loose gear under Convention 152, VTLs represent a unique cargo operation. The rules and guidance developed by ICHCA and ISO TC 104 reflect an adaptation of Convention 152's loose gear rules for VTLs, given the particular safety issues they pose, rather than a direct application of its requirements. Thus, for example, where the convention at Article 23 requires that loose gear to be ''thoroughly examined and certified'' every twelve months, ISO 3874 Amend. 2 requires only that twistlocks used in lifting be ''periodically examined'' (Ex. 40–9), and ICHCA would allow for a continuous inspection program of such twistlocks (Exs. 41, 8.1.3.3.3 & 8.1.3.3.4).

The final rule takes the same approach towards the convention in formulating rules for VTLs. In most respects—such as keeping twistlocks in good repair and working order, testing and certification before initial use, marking, and inspection before each use—the final rule's requirements are consistent with the convention's. The only significant departure is in the area of the annual thorough examination required by Article 23. Rather than require an annual thorough examination, OSHA has determined that all the necessary elements of a thorough examination of a twistlock may be performed before each lift (see Summary and Explanation below). It has thus required that these examinations to be performed before each lift and this has rendered an annual thorough examination and certification unnecessary. If anything, OSHA's approach may be more protective than that required by the convention.

Convention 152 itself allows variances if the change in question is not less protective (Art. 2.2; Ex. 41, 5.2.6), and as noted above, several international bodies have made their own departures from the annual thorough examination and certification requirement in this context. ICHCA has noted that under the convention: ''It is understood that some countries may impose a higher standard,'' (Ex. 41, 5.2.6), and some countries have already done exactly that (62 FR 40154). OSHA believes that the final rule is within the letter and spirit of ILO Convention 152, and it is therefore continuing its practice of maintaining consistency with the convention.

OSHA also considered ISO 3874 and the ICHCA VTL guidelines in the formulation of this final rule. While consistent in some ways with these documents, the final rule differs from them in at least two significant aspects: It allows VTLs only of empty containers, and it allows VTLs of only two containers—three container VTLs are prohibited. Nonetheless, this result is consistent with the TAA. As comprehensively explained in the Summary and Explanation, the record shows that ICHCA and ISO TC 104 used assumptions (e.g., the number of twistlocks engaged in a VTL and the acceleration forces experienced at the beginning of the lift) that did not adequately represent the forces experienced by corner castings and twistlocks in use. OSHA has used more appropriate assumptions in formulating its final rule. Therefore, OSHA has determined that for the purposes of the TAA, ISO 3874 Amend. 2 and the ICHCA guidelines (to the extent they may be considered an ''international standard'' for purposes of the TAA) are not ''appropriate'' standards upon which to base this final rule because they do not adequately protect ''human health or safety, animal or plant life or health or the environment'' (19 U.S.C. 2432(2)(B)).

IV. Significant Risk

An issue in any OSHA rulemaking is significant risk. In its Notice of Proposed Rulemaking (NPRM), the Agency preliminarily concluded that the procedures required in the proposal would substantially reduce the risk to employees of performing VTLs (68 FR 54298, 54302, September 16, 2003). Mr. Ronald Signorino, who testified at the July 29–30, 2004, hearing on the proposed rule on VTLs as a member of a panel representing the United States Maritime Alliance (USMX), remarked that, before OSHA promulgates a standard, it must find that a significant risk is present and can be eliminated or lessened by a change in practice (Ex. 54–2). He argued that the Agency had not made that threshold finding, as follows:

> There is no evidence in the record which establishes that VTL[s] are unsafe and that operational limitations over and above those appearing within international standards and guidelines are warranted. [Ex. 54–2]

As Mr. Signorino noted, the Supreme Court has held that before OSHA can promulgate any permanent health or safety standard, it must make a threshold finding that significant risk is present and that such risk can be eliminated or lessened by a change in practices (*Industrial Union Dept., AFL-CIO* v. *American Petroleum Institute*, 448 U.S. 607, 641–42 (1980) (plurality opinion)). The Supreme Court ruled that, before OSHA can issue a new standard, the Agency must find that the hazard being regulated poses a significant risk to workers and that a new, more protective, standard is ''reasonably necessary and appropriate'' to reduce that risk. The requirement to find a significant risk does not mean, however, that OSHA must ''wait for deaths to occur before taking any action,'' *Id*. at 655, or ''support its findings with anything approaching scientific certainty.'' *Id*. at 656. ''[T]he requirement that a 'significant' risk be identified is not a mathematical straightjacket.'' *Id*. at 655.

The Act allows OSHA considerable latitude to devise means to reduce or eliminate significant workplace hazards. Clearly, OSHA need not make individual quantitative or qualitative risk findings for every regulatory requirement in a standard. Once OSHA has determined that a significant risk of material impairment of health or well being is present, and will be redressed by a standard, the Agency is free to develop specific requirements that are reasonably related to the Act's and standard's remedial purpose. OSHA standards are often designed to reduce risk through an integrated system of safety practices, engineering controls, employee training, and other ancillary requirements. Courts have upheld individual requirements based on evidence that they increase the standard's effectiveness in reducing the risk posed by significant workplace hazards. See *Forging Indus. Ass'n.*, 773 F.2d at 1447–1452 (finding ancillary provisions of hearing conservation standard, including requirements for audiometric testing, monitoring, and employer payment for hearing protectors, reasonably related to the standard's purpose of achieving a safe work environment); *United Steelworkers*, 647 F.2d at 1237–1238 (finding lead standard's medical removal protection provisions reasonable).

While OSHA often uses fatality, injury, and illness reports and statistics to support its findings of significant risk, the finding of significant risk does not strictly require a history of injury. As Mr. Signorino noted, there is no evidence in the record of this rulemaking showing a worker injury due to VTL, despite the thousands of lifts that have occurred in the U.S. since 1986. However, evidence in the record does support a finding of significant risk for unregulated VTL operations. First, and foremost, as described in detail later in this preamble,[4] numerous VTL accidents have occurred in which employees were not injured. There is substantial evidence, discussed in more detail later in this preamble, that not all interbox connectors properly engage in VTLs, creating the risk of partial or complete separations. And the record contains evidence of at least nine VTL separations in the United States and Canada over the past 15 years, which are detailed later in this preamble. Any one of these accidents could have resulted in injury to or death of one or more employees. It was simply good fortune that worker injury was avoided. As the Supreme Court noted, OSHA need not ''wait for deaths to occur before taking any action,'' *American Petroleum Institute*, 488 U.S. at 655.

Second, the industry has acknowledged that VTLs are riskier than single lifts. As discussed in the background section of the ICHCA guidelines, ISO Technical Committee 104 recognized that there were potential hazards associated with VTL operations, and the committee asked ICHCA to develop a comprehensive document to deal with all aspects of VTL operations (Ex. 41). This acknowledgment was reinforced by the comments of Jimmy Burgin on behalf of the National Maritime Safety Association (NMSA) and the Pacific Maritime Association (PMA), who stated, ''As an initial matter the TC [NMSA technical committee] recognized that VTL operations are different, and must be treated differently than, normal single container lifts'' (Ex. 50–9). In addition, several individual companies testified that they follow the ICHCA guidelines to help assure the safety of VTL operations (see for example, Tr. 2–103), and some companies supplement the ICHCA guidelines with additional procedures to assure safe VTL handling (see for example, Tr. 2–128).

Third, the handling of individual containers has been determined in previous rulemakings to include risk (62 FR 40142–40144). The lifting of two or more containers cannot be less risky. VTLs introduce additional risk because more equipment can fail (twistlocks, corner castings, the container itself), the loads have a greater sail area that can be affected by wind, the loads have more sway, and VTLs are more difficult to transport on the ground. Also, compared to single lifts, the greater bulk of VTLs obscures more of the crane operator's view and thus potentially increases the likelihood of accidents. Finally, the safe transport of oversize loads and containers is recognized to require special procedures by other transportation interests, such as railroads and highway authorities (see, for example, 43 Texas Administrative Code, Chapter 28, Subchapters A–G).

Fourth, as discussed in detail in the next section of this preamble, OSHA's analysis of the strength of the components involved in VTLs demonstrates that lifting loaded containers in a VTL or lifting more than two containers in a VTL poses a significant risk of failure. It is widely a recognized engineering practice to impose sufficient factors of safety to ensure the safe lifting of cargo. An inadequate safety factor would result in significant risk. Without regulation, the Agency believes that employers would have an economic incentive to lift larger loads in VTLs, either by lifting loaded containers or by lifting more than two vertically coupled containers at the same time, thus reducing the safety factor to unacceptable values and causing a significant risk.

Thus, OSHA finds that VTLs pose a significant risk of injury to workers. The Agency notes that this finding of significant risk is proactive rather than reactive. It anticipates the possibility of injury and death that could result from VTLs conducted without special safety precautions and will regulate those problems before a worker is injured or killed.

OSHA also concludes that the final rule will substantially reduce that risk. Currently, employers are performing VTLs under the Gurnham letter (Ex. 2), which permits VTLs under conditions similar to those contained in the final rule. Several rulemaking participants, including Dennis Brueckner, representing the International Longshore and Warehouse Union (ILWU) Coast Safety Committee, testified that employers were not meeting the conditions set out in that letter when conducting VTLs (Tr. 2–369, 2–386, 2–407—2–408). By promulgating this final rule, the Agency anticipates that the percentage of employers complying with these conditions will increase.

Furthermore, the final rule includes additional provisions ensuring that interbox connectors are sufficiently strong so that they withstand, without failure, the forces that may be imposed during a VTL and provisions ensuring that inspections of interbox connectors, corner castings, and containers are conducted immediately before the lift. By ensuring that this equipment is adequately strong and in good condition immediately before a VTL, the final rule will substantially reduce the probability of failure and resulting accidents and injuries.

V. Summary and Explanation of the Final Rule

This section of the preamble discusses the important elements of the final standard and explains the purpose of the individual requirements. This section also discusses and resolves issues raised during the comment period, significant comments received as part of the rulemaking record, and any substantive changes that were made from the proposed rule. References in parentheses are to exhibits in the rulemaking record (Ex.) or to page numbers in the transcript of the public hearing held on July 29 and 30, 2004 (Tr.) or the Agency's public meeting on VTLs in January 1998 (1998–Tr.).[5]

[4] See the discussion of the issue titled ''Strength of the container-connector system'' under section V, Summary and Explanation of the Final Rule.

[5] Exhibits 100–X, 101–X, 102–X, and 103–X contain the transcripts for the 2-day hearing.

Continued

Except as noted, OSHA is carrying forward the language from the proposal into the final rule without substantive differences.

A. Strength of the Container-Connector System

OSHA originally proposed (68 FR 54298) to permit VTLs, that is, the lifting of two partially loaded intermodal containers, one on top of the other, connected by semi-automatic twistlocks or other interbox connectors under certain stated conditions. The proposal would have allowed VTLs with a maximum total weight of 20 tons (combined weight of the containers and cargo). The proposal also imposed a safe working load requirement for interbox connectors used in VTLs, based on ICHCA recommendations, of 10,000 kg.

Several rulemaking participants strongly objected to OSHA's proposal to permit VTLs of two partially loaded containers (Exs. 8A, 10–1, 11–1B, 11–1C, 11–1G). These rulemaking participants submitted considerable evidence on the safety of VTLs. In light of these objections and this evidence, OSHA has reconsidered the basis on which the Agency preliminarily concluded that lifting two partially loaded containers in tandem is safe.

After considering all of the evidence in the record, OSHA has concluded that the safety of VTLs can only be ensured under ICHCA's safe working load requirements when a maximum of two empty containers are lifted. Evidence submitted to the record reveals that a sufficient margin of safety does not exist, in all situations, when a combined load of up to 20 tons is hoisted in a VTL. In particular, operational considerations and dynamic forces limit the maximum load that can be safely lifted, as discussed fully later in this section of the preamble.

In a VTL, the uppermost container, its bottom corner castings, the interbox connectors, and the upper corner castings of the next lower container must be capable of supporting whatever loads are imposed by containers below the top one. Similarly, if more than two containers are lifted at a time, the intermediate containers, corner castings, and interbox connectors must be capable of supporting all loads below them. Thus, the strength of the container itself and the interbox connector-corner casting assembly is a key issue in the determination of whether VTLs are safe and, if so, under what conditions.

Drawings of a semi-automatic twistlock and the connection between twistlocks and corner castings are shown in Figure 1 and Figure 2. It should be noted that the load-bearing surface area is limited to the overlap between the flat surface of the cone of the twistlock and the inside surface of the corner casting at the top or bottom of the opening. The load-bearing surface area is shown in Figure 3.

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Volume 1 (Tr. 1-page) is the transcript for July 29, 2004, and Volume 2 (Tr. 2-page) is the transcript for July 30, 2004.

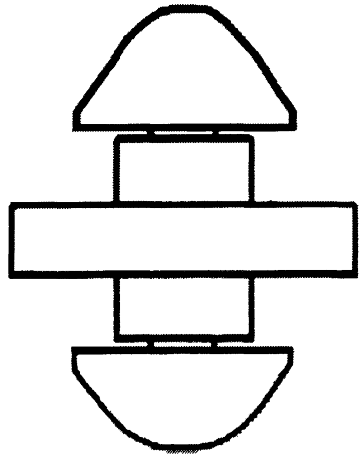

Figure 1—Semi-automatic Twistlock (Source: Ex. 11-6H)

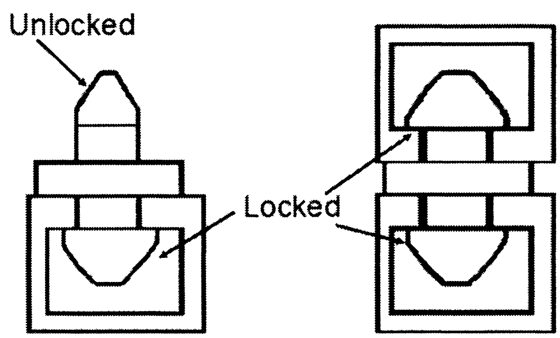

Figure 2—Interbox Connections (Source: Ex. 11-6H)

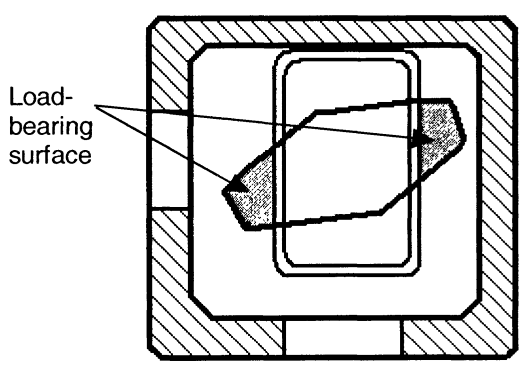

Figure 3—Load-bearing Surface of Interbox Connection (Source: Ex. 41)

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An explanation of basic strength of materials theory will clarify the underlying principles on which OSHA is basing its determination in this rulemaking.[6] These principles govern how materials react to external forces imposed on them. To simplify the discussion and avoid the need for the conversion of units between systems, the Agency is using the International

[6] The explanation of strength of materials theory is consistent with the discussion of this topic in Ex. 65–2. The information in this discussion is widely recognized material science.

System of Units exclusively in this discussion and in the analysis of the record that follows.

Stress is a measure of force per unit area within an object. It is the object's internal distribution of force per unit area that reacts to external applied loads. In the following discussion, stress is measured in newtons per square meter (N/m^2).

Strain is an expression of the deformation caused by the action of stress on an object. It is a measure of the change in size or shape of the object. In the following discussion, strain is unitless, though the amount of strain is sometimes given as a percent.

Stress may be applied to a material in a number of ways, including tension, compression, and shear. Compressive stress is stress applied so as to compress the material. Shear stress is stress applied parallel or tangential to the face of the material. Tensile stress, which is the primary concern in this rulemaking, is stress applied to pull a material apart. This is the predominant type of stress that a twistlock experiences during a VTL. The corner casting also experiences compressive and shear stress.

When material is stressed by the application of a tensile force, it will stretch and, when the stress is removed, return to its original size and shape as long as the stress is below the yield strength of the material. When the applied stress exceeds the yield strength of the material, it permanently deforms. When the stress exceeds the ultimate strength of the material, it catastrophically fails, or ruptures. A typical stress-strain curve is depicted in Figure 4.

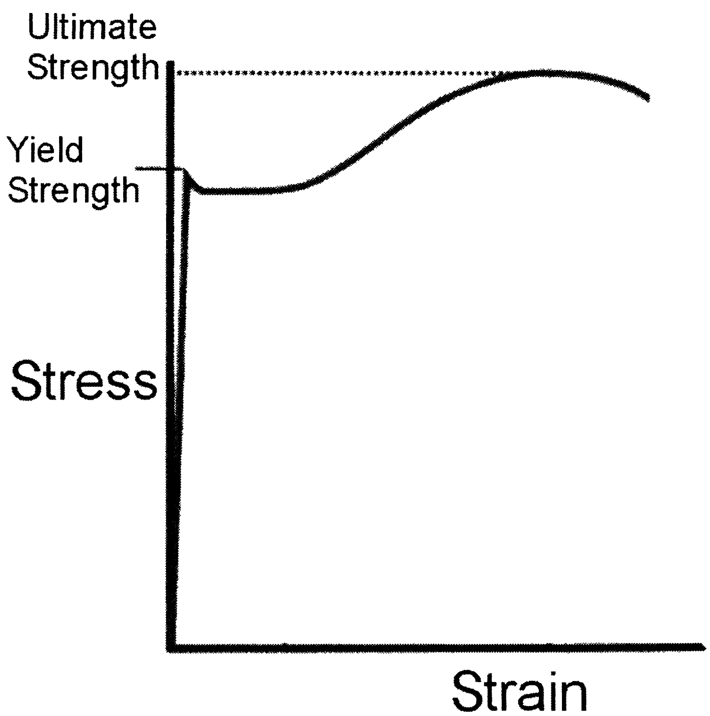

Figure 4—Stress Strain Curve for Steel

To limit the forces on a component to a safe level, engineers usually set a maximum stress limit on the material at a value much less than its yield strength. This is done using maximum rated loads and safety factors. A maximum rated load is the highest load permitted to be carried by the component. A safety factor is the ultimate strength[7] of a material divided by its maximum rated load. A sufficient safety factor will ensure that forces on the component do not approach its yield strength. The appropriate size of the safety factor to be employed is established by engineering judgment and is typically based on such factors as: The accuracy of load estimates, the consequences of failure, the possible effects of wear, and the cost and technological feasibility of overdesigning the component. For interbox connectors, the cost and technological feasibility of overdesign is not a consideration because, as described in more detail later, the design of at least some SATLs currently on the market have sufficient strength to provide an adequate safety factor (Ex. 40–10). In general, the safety factor is adjusted upwards to account for increasing uncertainty about the loads and forces imposed by real-world conditions.

ISO Technical Committee on Freight Containers, Technical Committee 104, develops international standards for the design and testing of freight containers and for container handling and securing (Ex. 41). Standards under the purview of ISO/TC 104 deal with structural issues that relate to the ability of a freight container to be handled and safely transported (Ex. 41). Table 1 lists the relevant ISO/TC 104 standards that relate to VTLs.

[7] As noted earlier, the ultimate strength is the maximum stress a material can withstand before failure, and stress is measured in N/m^2. However, when dealing with components, the cross-sectional area is constant, and loads (in N) are usually substituted in the calculation of safety factors.

TABLE 1—ISO STANDARDS RELEVANT TO VTLS

ISO standard No.	Title
ISO 668:1995	Series 1 freight containers—Classification, dimensions and ratings.
ISO 1161:1984 (Ex. 11–6B)	Series 1 freight containers—Corner fittings—Specification.
ISO 1161:1984/Cor. 1:1990 (Ex. 11–6B)	Technical corrigendum 1:1990 to ISO 1161:1984.
ISO 1496–1:1990 (Ex. 11–6D)	Series 1 freight containers—Specifications and testing—Part 1: General cargo containers for general purposes.
ISO 1496–1:1990/Amd. 1:1993	Amendment 1:1993 to ISO 1496–1:1990, 1 AAA and 1 BBB containers.
ISO 1496–1:1990/Amd. 2:1998	Amendment 2:1998 to ISO 1496–1:1990.
ISO 3874:1997 (Ex. 11–6C)	Series 1 freight containers—Handling and securing.
ISO 3874:1997/Amd. 1:2000	Amendment 1:2000 to ISO 3874:1997, Twistlocks, latchlocks, stacking fittings and lashing rod systems for securing of containers.
ISO 3874:1997/Amd. 2:2002 (Ex. 40–9)	Amendment 2:2002 to ISO 3874:1997, Vertical tandem lifting.

Source: Ex. 41.

ISO 1161 sets detailed specifications for the dimensions, design, and strength of corner castings. The design requirements in this standard call for top corner castings to have design loads for lifting of 150 kN. Bottom corner castings are in most significant respects identical to top corner castings. Therefore, they can be expected to have the same strength.

ISO 1496–1 sets specifications for Series 1 freight containers. The requirements in this standard ensure that such containers are adequately strong for the lifting and in-use conditions they are likely to experience.

ISO 3874 sets requirements for the dimensions and strength of twistlocks. This standard requires twistlocks to have a minimum load-bearing surface of 800 mm^2 and, for those used for lifting, to be capable of withstanding a tensile force of 178 kN without any permanent deformation. The test used to determine compliance with the tensile strength requirement must be made using two corner castings or equivalent devices.

OSHA had relied on two studies, a Swedish National Testing and Research Institute's (SNTRI) study, ''Container Lashing'' (Ex. 11–6H), and a NIST study, ''Strength Evaluation of Connectors for Intermodal Containers'' (Ex. 40–10), to support its proposal. The Swedish study focused primarily on the ability of containers, interbox connectors, and lashing equipment to withstand the forces likely to be imposed while being transported aboard a vessel. However, both studies evaluated the strength of interbox connectors and corner castings.

The NIST study included site visits to port facilities and laboratory tests of interbox connectors. At the time of the NIST study, approximately 12 manufacturers produced most of the interbox connectors used by the shipping industry. NIST contacted U.S. representatives of eight manufacturers, and four provided interbox connectors for testing. For the failure load test of connector shafts loaded in tension, two new interbox connectors were used from each of the four manufacturers, and two used interbox connectors were used from two of the four manufacturers, for a total of 12 interbox connectors.

Test specimens included semi-automatic twistlocks and latchlocks. The engineering study included the testing of twistlocks in tension, twistlock and latchlock assemblies with corner castings in tension and compression, and shafts of twistlocks in tension to obtain the stress-strain relationship. In addition, NIST measured the bearing surface areas of the top and bottom cones of twistlocks and latchlocks on the inner surfaces of the corner castings.

The NIST study revealed that the ultimate tensile loads [8] of the twistlock shafts tested ranged from 562 to 802 kN. The SNTRI study reported similar test results in 1997, with ultimate tensile loads ranging from 477 to 797.1 kN.[9] Although a limited number of used connectors were tested in the NIST study, the test results indicated that, when their respective shafts were loaded in tension, the used twistlocks withstood a greater test load than the new twistlocks (Ex. 40–10). The study also indicated that the strength of a twistlock-corner casting assembly was lower than that of a twistlock alone. The maximum test loads for twistlock-corner casting assemblies ranged from 408 to 710 kN, or roughly 80 percent, on average, lower than the ultimate strength of the twistlock shaft alone. The report described the reason for this as follows:

> [T]he capacity of the assembly is limited by failure of the corner fitting. Failure was brought about by large permanent deformations of the aperture of the corner fitting and/or shearing at the perimeter of the aperture * * * A relatively small bearing area of the cone on the corner fitting caused a concentration of force near the edge of the aperture, and as a result, the edge of the cone sheared through the top plate of the corner fitting.[10] [Ex. 40–10]

ISO 3874 requires that the load-bearing area between a twistlock and a corner casting be a minimum of 800 mm^2. Because stress increases with decreasing cross-sectional area, the bearing area is critical to the ability of the interbox connector to withstand lifting loads. The NIST study showed that the measured bearing area of latchlocks tested on the corner casting was less than that given in ISO 3874. Furthermore, the report stated that the maximum test load for a latchlock-corner casting assembly was as low as 90 kN when the latch was not fully extended. For these reasons, OSHA has concluded that latchlocks are not suitable connectors for VTLs. The report also noted that three of the six twistlocks also failed to meet the ISO provisions on minimum load-bearing area with the largest acceptable opening on a corner casting (these openings are a maximum of 65.0 mm wide). Because the strength of the twistlock-corner casting assembly depends on this load-bearing area, as described in the NIST report, the final rule requires twistlocks used in VTLs to be certified as having a minimum load-bearing surface area of 800 mm^2 when connected to a corner casting with an opening of the maximum width permitted by the ISO standard (65.0 mm).

[8] The ultimate tensile strength of a material is the maximum unit stress that a material can withstand when subjected to an applied load in a tension test. Because stress is force (the load) divided by the cross-sectional area, the ultimate tensile stress is proportional to the maximum tensile load applied to a test specimen during the test. This load is known as the ultimate tensile load.

[9] The Swedish study tested only three semi-automatic twistlocks. Furthermore, the tensile tests were limited to SATLs alone; they were not performed on SATL-corner casting combinations.

[10] It should be noted that the twist lock-corner casting combination failing with the smallest tensile load (408 kN) failed when the cop cone pried off the shaft of the twistlock.

A number of rulemaking participants, including the Institute of International Container Lessors, the Carriers Container Council, Inc., and the USMX, argued that VTL operations were safe up to a total load of 20 tons and, in that sense, supported the proposal (Exs. 10–4, 10–5, 10–6, 36, 37, 47–2–1, 50–12, 54–1–1, 54–2, 54–3, 65–3). In support of their position that VTLs are safe, two of these commenters stated that they were unaware of any reported injuries resulting from lifting vertically coupled containers (Exs. 10–5, 10–6). For example, the Carriers Container Council, Inc. (Ex. 10–6), said:

> The fact that there has not been one reported injury as a result of this practice is evidence that the precautions being applied by terminals performing these lifts are sufficiently protective.

On the other hand, there have been documented VTL events and accidents in the Port of Charleston, South Carolina, in Honolulu, Hawaii, and in Houston, Texas (Exs. 8–A, 11–1–B, 11–1–H, 11–1–K, 11–1–M, 11–3, 11–3–A, 11–3–B, 43–10, 45–1, 61, 62). The International Longshoreman's Association reported that at the Port of Charleston, two 12.2-meter refrigerated containers became uncoupled while in midair (Exs. 8–A, 11–1–B, 11–1–K, 11–1–M, 11–3–A, 11–3–B, 43–10). The ILA also reported two incidents at this port in which the bottom 12.2-meter container of a three-container VTL released in midair (Exs. 11–1–K, 43–10). The ILWU reported two midair separations of the bottom container of two-container lifts in Honolulu, resulting in the lower container crashing to the dock or the deck of the ship, respectively (Exs. 11–1–B, 11–1–H, 43–10, 62). One of these VTLs comprised loaded containers; the other appears to have been empties (Exs. 11–1–H, 62). The ILWU also provided testimony about an event in Canada in which a two-container VTL carrying loaded twistlock bins separated when all four of the twistlocks connecting them broke (Tr. 2–285—2–286, 2–333—2–335).

APM/Maersk reported a VTL separation occurring in Houston while employees were loading a barge with empty containers, in which two twistlocks broke during a lift, causing the bottom container to fall 1.2 to 1.5 meters to the dock (Ex. 61).[11]

The ILWU further argued:

> The ILWU believes that other such accidents have occurred and that there has been poor reporting of them.
>
> * * * * *
>
> The fact that no one has yet been injured or killed as a result of these operations is merely extreme good fortune. [Ex. 11–1P]

Mr. Ross Furoyama, testifying on behalf of the ILWU, stated that in his experience near-misses are not reported (Tr. 2–395). He described what happened as follows:

> [W]hen they are taking [a VTL] up to a ship, there will be instances where they would lift, the back would alligator, because the cones did not activate properly, then it will slam back down, jarring the crane cab operator. This happened numerous times. I couldn't count how many times it happened during a ten hour operation. [Tr. 2–396; see also Ex. 11–1–H]

Mr. Furoyama also testified that he observed corners unlock in VTLs after prelifts as the containers were being lifted (Tr. 2–396). Mr. Matthew Lepore, an ILA crane operator working for Sea-Land in Port Elizabeth, NJ, testified about two separate occasions when a twistlock disengaged as a VTL was traveling from a ship to the dock (Ex. 20). He also testified that he has observed VTLs separate on one end or be attached by only one twistlock (1998–Tr. 236–237).

Mr. Tyrone Tahara estimated that there was approximately one separation for every 40 lifts (Tr. 2–405).

OSHA does not believe that the lack of injuries in VTL operations to date is an indication that these operations are safe. At least eight incidents in this country have been reported in the 15 years since the Agency issued the Gurnham letter to Sea-Land in 1993.[12] In addition, VTLs represent a fraction of the total number of container lifts, as described by the ILWU:

> [A]t least 100,000 single picks of containers are made daily in United States ports. Despite this enormous volume of single container hoists, dropped containers are an extremely rare event. By comparison, there have been relatively few tandem picks of containers during the past five years. According to SeaLand statements, 150,000 to 200,000 vertical tandem lift hoists have been made during this period. This is equivalent to one to two days of standard container single pick operations. Consequently, it is clearly evident that even with this insignificant number of vertical tandem hoists that, statistically speaking, there have been an extremely large number of VTL hoist accidents. [Ex. 11–1–B]

The conditions in the Gurnham letter restrict the number of VTLs to empty containers only. Furthermore, labor agreements in many ports prohibit VTLs. There was also largely unrebutted testimony that partial separations occur, with some witnesses claiming that partial separations are relatively commonplace (Tr. 2–396, 2–405). Although many of these partial separations occurred during prelifts, the frequency at which they occur is a strong indication that a significant portion of VTLs are accomplished with one or more twistlocks disengaged from their associated corner castings. This experience calls into question the assumptions (1) that forces imposed by VTLs would be distributed over four twistlock-corner casting combinations and (2) that forces would be evenly distributed over these combinations. As will be seen later, these are key assumptions made in the calculation of safe working loads conducted by several parties and submitted to the record.

A number of commenters believed that vertical tandem lifting is an unsafe practice regardless of the weight of the load (Exs. 8A, 10–1, 11–1B, 11–1C, 11–1G). Their major concern was disengagement or failure of one or more interbox connectors or corner castings. The position against VTL operations was taken primarily by union groups, such as the International Longshoremen's Association (ILA, Exs. 8A) and the International Longshore Warehouse Union (Ex. 11–1B), as well as other participants: Germanischer Lloyd, the German shipping industry classification society (Ex. 11–1C), W. A. Verwoerd, Inspector, Port of Rotterdam (Ex. 10–1), and former OSHA Regional Administrator James W. Lake (Ex. 11–1G).

OSHA believes that disengagement or the failure of a twistlock to engage the corner casting fully is a significant concern. When this happens, the remaining twistlocks and corner castings must support a greater portion of the load. As noted earlier, this is a concern in a significant portion of the lifts, and the final rule must account for this possibility. For VTLs to be permitted, the final rule must set requirements that are reasonably necessary and appropriate to prevent failure of a twistlock or corner casting during these operations. This can be done by using adequate safety factors and conservative estimates of the ultimate strength of twistlocks and

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[11] In addition, as noted in the ANPR, Sea-Land reported two VTL incidents involving twistlocks that would have been avoided by following proper practices. In the first, the VTL separated at one end because the two front twistlocks did not enter the corner castings of the lower container, and as a result Sea-Land instituted a prelift procedure (1998–Tr. 206). In the second, 13.7-meter containers were hoisted in a VTL, against company policy, and the twistlocks released when the VTL struck the crane's legs (1998–Tr. 206–207).

[12] OSHA had issued a similar letter to Matson in 1986. However, unlike Sea-Land, which reported the three incidents on the record, Matson apparently did not have a mechanism to report near-misses associated with VTL operations, and there was evidence in the record that Matson did experience separations that were not reported (Tr. 2–410—2–411).

corner castings in developing the final rule.

During the rulemaking, several parties raised issues as to whether the NIST and Swedish studies properly considered all significant factors in evaluating the safety of VTLs (Exs. 11–1B, 50–11–2). Robert N. Anderson, Ph.D., P.E., an expert in forensic materials (the investigation of materials, products, structures or components that fail or do not operate or function as intended) and metallurgical engineering and sciences, testified on behalf of the ILWU (Ex. 50–11–2). He pointed out underlying problems with the NIST report, as well as the Swedish National Testing and Research Institute's report. According to Dr. Anderson, both reports were incomplete because they lacked data that would assist in determining the dynamic behavior of the interbox connectors during a VTL. In addressing the NIST report, he stated,

> I found in analyzing this report that it does not support using connectors for intermodal containers and moreover, the data shows that the connectors they tested were not suitable for the intended purpose.
>
> * * * * *
>
> In my opinion, the NIST report is incomplete in that it only looks at static or slow applied loads. In addition there is no information on the hardness from heat treating of the connectors, or on their resistance to fatigue loading. However, there is enough information to determine that the connectors are not suitable for intended use. [Ex. 50–11–2]

He also faulted the Swedish study, stating:

> Apparently the SNTRI used an INSTRON testing machine * * * which is suitable only for static slow strain rate loading. Therefore, its shortcomings are comparable to the NIST report, and their work is not appropriate to determining the dynamic behavior of the interbox connectors during a VTL. [Ex. 50–11–2]

NIST made no attempt to conduct a statistically rigorous testing program, but only attempted to assess in broad terms the structural performance of the connectors and identify their failure mechanism and the weakest link. It only tested several twistlocks out of the hundreds of thousands that are in current use, and this is not a statistically significant sample from which a decision can be reached about the quality of SATLs in general. Indeed, the NIST report warned that the results should not be extrapolated to other types of connectors not included in the study (Ex. 40–10).

Another limitation of the NIST study was that it focused on investigating interbox connectors and connector-corner casting assemblies only. No attention was given to the overall structural integrity of the container. As NIST pointed out, the welded connection between the corner casting and the corner post may present a weaker connection than the connector-corner casting assembly (Ex. 40–10).

OSHA has concluded that the testing performed by NIST and the Swedish National Testing and Research Institute does not, by itself, demonstrate what are the strengths of twistlocks and corner casting combinations. As noted earlier in this section of the preamble, the ISO design requirements tightly control the dimensions and material strength of corner castings. This is evidenced by the need to ensure dimensional compatibility so that the containers can be readily stacked for shipment. If container did not closely follow the ISO standards, stacking and transporting the containers would be problematic. For this reason, the NIST testing results are likely representative of existing and future corner casting designs, and OSHA has concluded that further regulation of corner castings is unnecessary. However, as NIST noted, the testing was not of a statistically significant sample of twistlock designs, as this would require testing multiple samples of as many twistlock designs as possible. In addition, even if the testing were representative of all existing twistlock designs, it would not be valid for designs that may be produced in the future. The ISO standards do not control the dimensions of the cones on twistlocks nearly as tightly as they do the corner castings. Therefore, the Agency must look to product standards to determine what strength requirements apply to this equipment.

As noted by Michael Bohlman, Director of Marine Services for Sea-Land Service, who authored a number of papers on freight containers and related technology, the ISO standards require corner castings to safely handle a tensile force of 150 kN over a minimum load-carrying area of 800 mm^2 of the interior horizontal face surrounding the aperture (Ex. 50–10–2). According to his prepared testimony, the ISO standards limit the loading on twistlocks and corner castings used in VTL operations to 75 kN (Ex. 50–10–2). In addition, as noted earlier, ISO 3874 requires twistlocks used for lifting to be capable of withstanding a tensile force of 178 kN without permanent deformation. Mr. Bohlman stated that this results in a structural safety factor of five based on the ultimate tensile strength of the components.

However, this safety factor is apparently based on the results of the tests performed by NIST and the Swedish National Testing and Research Institute, not on design requirements in the ISO standards themselves (Tr. 1–41—1–42).[13] Using a safety factor of five, the ultimate strength of components with a 150-kN safe working load should be 750 kN. As noted earlier, the NIST study found that the ultimate strength of the twistlock-corner casting assemblies they tested was as low as 408 kN. Based on this value, which may not be representative of the weakest combination twistlock-corner casting assembly, the maximum safe working load for a safety factor of five would be 80 kN. Twistlock-corner casting assemblies that were not tested, and those produced in the future might be even weaker.

In addition, as noted earlier, NIST found that some twistlocks had insufficient bearing areas when connected to corner castings with the largest acceptable openings based on tolerances given in ISO 1161 (Ex. 40–10). Furthermore, the twistlock-corner casting combination failing with the smallest tensile load (408 kN) failed when the top cone pried off the shaft of the twistlock (Ex. 40–10). Because the corner casting dimensions and strength are tightly controlled by the ISO standards, the ultimate strength of the twistlock-corner casting assembly is dependent on the bearing surface area of the twistlock and the ability of the twistlock to withstand tensile forces when loaded on this bearing surface.

For these reasons, OSHA does not believe that the ISO standards adequately regulate the ultimate strength of semi-automatic twistlocks when used in combination with a corner casting. Therefore, as explained more fully later in this section of the preamble, the Agency has decided to impose a requirement for all twistlocks used in VTLs to have a minimum load-bearing area of 800 mm^2 and a safe working load of 10,000 kg with a safety factor of five [14] when tested as an assembly with standard corner castings with openings that are 65.0 mm wide. OSHA believes that imposing these requirements will ensure that all components used in VTLs will be strong enough to perform such lifts without failure provided the other conditions imposed by the final rule are met. This requirement will also provide assurance that the calculations are based on valid

[13] There is a provision for a safety factor of five in section 5.1.6 of ICHCA's "Vertical Tandem Lifting of Freight Containers," but this is a guideline, not an international standard.

[14] The minimum ultimate strength of a corner casting meeting this requirement is 490 kN (10,000 kg * 5.0 * 0.00980665 kN/kg).

assumptions about the strength of interbox connections.

OSHA has also determined that a safety factor of five will be sufficient to protect employees from the hazards of component failure and that this safety factor is reasonable and consistent with good engineering practice. ISO Technical Committee 104, which has jurisdiction over ISO standards related to containers, used a safety factor of five in its calculations for developing standards on VTLs (Ex. 50–10–2). A report by ICHCA International Limited, entitled ''Vertical Tandem Lifting of Freight Containers,'' claimed a safety factor of five in their calculations and specifically imposed a safe working load for lifting on twistlocks used for VTLs of 10,000 kg ''on the basis of a safety factor of not less than 5'' (Ex. 41). Michael Bohlman stated that a safety factor of four or five is commonly used in setting standards for cargo handling and securing (Ex. 50–10–2, see also Ex. 41).[15] The Agency has thus concluded that a safety factor of five is reasonably necessary and appropriate.

Testifying on behalf of the USMX, Mr. Michael Arrow, P.E., an expert in the area of container engineering and manufacturing specifications and international standards, testified on the strength of containers and twistlocks. He said:

On the issue of strength of containers and lift locks, as OSHA acknowledges, the NIST study notes that corner castings may fail before semi-automatic twist-locks fail.

Contrary to the opinion of another commentator, this does not mean that the corner fitting is weak or dangerous, or likely to fail when VTL operation is conducted according to OSHA and ICHCA requirements.

The NIST study tested corner fittings, twistlocks, and combinations of these to destruction in order to determine the load that would cause ultimate failure.

The NIST study concluded that this tensile failure load of the combined corner fitting and twistlock assembly was not less than 408 [kN], or 91,800 pounds, and ranged as high as 710 [kN], or 159,000 pounds.

However, both ISO and ICHCA allow a maximum tensile load of only 75 [kN], or 16,875 pounds, meaning that even the weakest assembly tested has a safety factor of more than five.

Such a safety factor is sufficient with tests to a safe working load that exceeds ISO and ICHCA requirements. It should also not be forgotten that the NIST tested assemblies consist of a twist-lock and a corner fitting.

This means that both components exceed the safe, conservative safe working load. That the corner fitting ultimately may fail before the twist-lock does is technically irrelevant. [Tr. 1–41—1–42]

Michael Bohlman maintained that the ISO-required tests were more than adequate to ensure that intermodal containers are capable of safely performing tandem lifting. In his prepared testimony for OSHA's public meeting in 1998, Mr. Bohlman presented his views on ISO test methods as follows:

ISO 1496 establishes a series of tests to determine the adequacy of a container to perform its fundamental cargo carrying function within the multimodal operating environment. The tests were devised by ISO TC 104 specifically to test and verify the adequacy of the container to survive in the real world. They are static tests developed with appropriate factors of safety considered to reflect the dynamic loads containers are subject to during transportation and cargo operations. These static tests provide a margin of safety for dynamic, full load operating conditions. Dynamic testing was specifically avoided because it is much more dangerous, less reproducible and more expensive [than] static testing without any demonstrable benefit. [Ex. 18]

In his prepared testimony for OSHA's public hearing in 2004, Mr. Bohlman stated that the ISO Technical Committee 104 concluded that partially loaded containers could be safely handled in a VTL, and the forces to which the containers would be subjected would be within their design strength (Ex. 50–10–2). According to Mr. Bohlman, the committee's conclusion was based on the structural testing of corner castings and twistlocks conducted by NIST and the Swedish National Testing and Research Institute, as well as the committee's own deliberations and calculations. In his prepared testimony, he stated:

ISO/TC 104 concluded that the existing design and testing requirements contained in the TC 104 family of standards cover VTL operations. We determined that containers, their fittings and the twistlocks specified in the ISO standards have sufficient structural strength to allow VTL operations to be safely carried out within the limits specified in the [relevant ISO] standards. [Ex. 50–10–2]

OSHA has concluded that ISO TC 104 provided for a safety factor of five[16] based, in part, on (1) the ultimate strength of twistlock-corner casting connections being adequately represented by the NIST and Swedish testing and (2) all four twistlock-corner casting connections being fully engaged during VTLs. As explained earlier in this section of the preamble, OSHA has concluded that the NIST and Swedish studies do not, by themselves, demonstrate the ultimate strengths of twistlocks. Because TC 104 relied on the results of these two studies to set safety factors, the Agency further concludes that the analysis performed by TC 104 in setting VTL standards is flawed. In addition, the committee did not account for disengaged connections in their analysis. The Agency believes that it is essential for employee safety to ensure that VTLs are safe even when up to two twistlock-corner casting connections are disengaged. As described earlier, the record shows that it is not uncommon for employees to encounter two disengaged twistlocks during VTL operations. When the twistlocks at two adjacent corners are disengaged, the containers will partially separate and provide evidence during the prelift that the twistlocks are not fully engaged. However, twistlocks at opposite corners may give little indication that they are disengaged during the prelift. In fact, Michael Bohlman, testifying on behalf of USMX, stated that an employee would have to be looking closely to be able to tell that twistlocks on opposite corners were disengaged (Tr. 1–177). Based on evidence from employee representatives (Exs. 43–10, 50–7; Tr. 1–345), OSHA does not believe that employees during the loading or unloading of a container vessel are likely to examine the connections that closely. Thus, OSHA has concluded that VTLs must have a safety factor of five when only two twistlocks, at opposite corners, are engaged.[17]

The ILWU (Ex. 11–1B) raised a number of objections regarding the safety of vertical tandem lifting. Their objections, at least in part, were based on the underlying premise that SATLs were designed to connect and secure

[15] Mr. Bohlman also stated that the safety factor is the ratio between the ultimate strength and the safe working load. However, as noted earlier, ISO standards do not specify the ultimate strength of twistlocks or corner castings. The safety factor in those standards is based on the anecdotal testing performed by NIST and the Swedish National Testing and Research Institute.

[16] Amendment 2, ''Vertical Tandem Lifting'' (July 1, 2002) to ISO 3874, *Series I Freight Containers—Handling and Securing,* added a new section 6.2.5, and two footnotes to that section (Ex. 40–9). The new section requires twistlocks used in VTLs to be ''certified for lifting.'' One of the footnotes reads: ''The certification process envisaged is to use a safety factor of at least four based on the ultimate strength of the material.'' However, ISO TC 104 used a safety factor of five in the ICHCA guidelines (Ex. 41) in sections 5.1.6 and 8.1.3.1.2. The ICHCA guidelines were published in 2003, after Amendment 2 to ISO 3874. In fact, the guidelines call for twistlocks manufactured after December 31, 2002, and used in VTLs to be certified as having a safe working load of 10,000 kg with a safety factor of not less than five. Thus, OSHA has concluded that ISO TC 104 provided for a safety factor of five.

[17] Mr. Bohlman also testified that VTLs could be performed safely when only two twistlocks were fully engaged (Tr. 1–99—1–100). However, in such cases, the safety factor would be reduced by a factor of two. With a safety factor of five with four fully engaged twistlocks, the safety factor is reduced to 2.5 when only two twistlocks are fully engaged, which OSHA believes is unacceptable.

intermodal containers that are stowed on the deck of a vessel, and were not intended to be used to lift multiple containers. The ILWU stated:

Clearly, twistlocks (SATL's) are not designed to lift containers. As their name indicates, twistlocks are designed and manufactured as locking or securing devices. It is instructive to compare SATL's which are manufactured as securing devices with the twistlocks found on container hoisting beams. Container beam twistlocks are *designed to hoist containers.* They are machined from a block of high grade steel. They are tested and certified and subject to periodic inspection and recertification. They are designed to turn a full 90 degrees into the locked position; this ensures a maximum bearing surface for hoisting.

In comparison, SATL's designed as securing devices are predominantly manufactured from cast parts, using metal considerably inferior to that utilized in container beam twistlocks. Also, SATL's do not turn 90 degrees into a full locking position. Almost all SATL's have a considerably smaller bearing surface than that of twistlocks on container beams. This is because SATL's *were not designed to act as lifting devices.* [Ex. 11–1B, emphasis included in original document]

The ILWU also argued that the age and abuse SATLs receive could contribute to failure over time (Ex. 11–1B). They believe that more failures are likely in the future.

Mr. Ronald Signorino, president of The Blueoceana Company, Inc., and representing the USMX at OSHA's public hearing in 2004, stated that much of the gear manufactured years ago was vastly inferior to that which is the norm in today's marine cargo handling and marine transportation world (Ex. 50–10–1). He stated that the quality of steel used currently in manufacturing gear is far superior in today's products.

Mr. Arrow countered ILWU's assertion that semi-automatic twistlocks were not originally designed for lifting of containers in the VTL operating mode (Ex. 50–10–3-1). Mr. Arrow, representing the USMX, pointed to the NIST study as proof that such twistlocks are more than capable of handling VTL lifting stresses. He also disputed ILWU's assertions regarding safe working strengths of connectors relative to their history and age. He claimed that the NIST study selected both well used and new test specimens and that the results of their testing revealed that some used specimens were stronger than the new specimens.

Dr. Anderson testified that the likely reason for the increased strength of the well used twistlocks was that they had been work hardened, giving them extra tensile strength but also making them more brittle (Tr. 2–255—2–256). However, as noted in a posthearing submission (Ex. 65–2), the plastic deformation that occurs when a material is loaded beyond its yield point does not result in an increase in ultimate strength. In his posthearing submission, Dr. Anderson replied that the evidence he examined did not address the cause of the higher maximum test load for used connectors found in the NIST report (Ex. 68–1). He concluded:

Since no other metallurgical testing was performed by NIST or LPI on used connectors and no further data is available, the logical conclusion is that the connectors have strain hardened by plastically deforming. This would produce an increase in yield strength, a reduced toughness and increased sensitivity to stress corrosion cracking. More importantly, it indicates that the used connectors were over stressed and plastically deformed during their use. [Ex. 68–1]

During use, twistlocks are subjected to varying dynamic and static forces. Their use to keep containers from displacement while at sea imposes compression and shear forces (Tr. 1–45—1–46). Their abuse at ports during container stacking and unstacking, with containers slamming against them and with their being dropped to the deck and to ground (Tr. 2–396—2–397, 2–404), could strain harden, or cold work, the twistlocks and increase the yield strength, if not the ultimate strength, of the twistlocks. Dr. Anderson's point that cold working the twistlocks also makes them more brittle, and thus more subject to cracking, was uncontroverted. At a minimum, this evidence points to a need for an examination of each interbox connector before use in a VTL to ensure that there is no obvious evidence of cracking.

There is insufficient evidence in the record to determine why the used twistlocks had higher ultimate strengths than new ones. It could be that newer designs have less strength, or it may simply be an indication of the range of strengths of these devices. The fact that used twistlocks had higher ultimate strengths has no effect on OSHA's determinations in this rulemaking. As explained previously in this section of the preamble, the Agency has concluded that it cannot rely solely on the NIST and Swedish tests to determine the ultimate strength of twistlocks. In any event, it is the minimum ultimate tensile strength of twistlock-corner casting connections that must be used to calculate the maximum safe working load. This ensures that the minimum acceptable safety factor is met for the weakest available combination. The standard's requirement that twistlocks used in VTLs have a minimum safe working load of 10,000 kg with a safety factor of five when connected to corner castings with openings that are 65.0 mm wide will ensure that the interbox connections can safely support VTLs under the worst reasonably anticipated conditions.

The ILWU was also concerned about the strength of welds in corner castings and posts, frequently finding them loose, damaged, or improperly connected.

Union mechanics regularly discover improper attachment of lower corner castings to corner posts and faulty repair work. Frequently, lower corner castings are discovered to have been "tack welded" back into place or welds are found to have no penetration. Often there is a lack of fusion of ferrous metals even when welding has been done. It is not unusual for ILWU mechanics to have to remove a container's cargo and the container floor to properly repair bottom corner castings. [Ex. 11–1B]

Mr. Arrow replied that ISO/TC 104 and ICHCA developed standards, testing procedures, and guidelines for vertical tandem lifting that takes these factors into account (Ex. 50–10–3-1).

OSHA agrees, in part, with Mr. Arrow. The Agency believes that the ISO standards provide adequate assurance that the ultimate strengths of the welded connection of the corner casting to the container and the container corner posts are sufficient for VTLs. After all, the strength of these components must be adequate to ensure that lifts of single containers, which when loaded can weigh substantially more than the total weight of all the containers in a VTL,[18] can be performed safely. Inadequately strong welds or corner posts would lead to container failures during single-container lifts, and evidence in the record shows that problem welds are detected in visual inspections and corrected (Tr. 1–44—1–45). The forces on these components in a VTL meeting the requirements imposed by the final rule will generally be no higher than the forces imposed when a single, fully loaded container is lifted. In fact, a bad weld would pose a greater hazard for a fully loaded container lifted alone because the forces on the weld would be higher during such a lift than during a VTL. Thus, OSHA believes that the condition of welds merits no greater consideration for VTLs than for lifts of single containers loaded to their maximum weights. The final rule addresses the adequacy of welds by requiring visual inspection of the container immediately before a VTL is conducted and

[18] Loaded containers with a maximum gross mass of more than 30,000 kg are not uncommon.

prohibiting VTLs when welds are found to be defective.

In his notice of intention to appear at the 2004 public hearing, Dr. Anderson further criticized the failure to consider dynamic forces. He stated that he had reviewed prepared testimony and the reports that were submitted to OSHA on vertical tandem lifting (Ex. 50–8). He claimed that a number of presenters, safety panels, groups and associations that had calculated the effect of wind speed on a multiple container lift made errors in their calculations by considering all forces to be constant. He stated that no consideration was given to gusts of wind or wind shear, and consequently ''the dynamic situation is ignored and the static situation is put forward as the only issue.'' He requested that OSHA do further testing and that strain gage data from the connectors and corner castings should be collected during actual vertical tandem lifting to determine the actual load dynamics experienced by the connectors. Dr. Anderson suggested that NIST be asked to repeat their tests or to show the full results from their tests of used connectors. In addition, he felt that NIST should determine the damage tolerance of the connectors in normal use, the fatigue behavior of the connectors, and the susceptibility of the connectors to stress corrosion cracking.

Mr. Bohlman stated that the ISO Technical Committee considered the maximum wind loading that could be imparted to an interlocked VTL unit of containers by a 100-km/h wind, the tare weight of the coupled empty containers, and the weight that could result from the cargo within the containers (Ex. 50–10–2). He argued that a structural safety factor of five was used in the calculations carried out by ISO. In addition, he stated that the technical committee used a constant wind load equivalent to an additional 28.9 kN load inside the coupled containers in the calculations to account for wind loading. Mr. Bohlman stated that, based on these considerations, the ISO concluded that a gross weight of up to 219 kN could be safely handled as a VTL.

USMX and the Pacific Maritime Association engaged Lucius Pitkin, Inc., Consulting Engineers to perform strain gage tests on VTL components in simulated terminal conditions (Ex. 65–1). In its report, the consulting firm, which specializes in engineering analysis and failure investigation, responded to questions raised at the hearing concerning the adequacy of reliance on the NIST and Swedish reports. Lucius Pitkin's report presented the results of a series of strain gage and accelerometer tests of twistlocks and container corner castings performed during vertical tandem lifting and horizontal movement out over the water (Ex. 65–3). Carol Lambos, the attorney representing USMX, submitted the report in December 2004 during the posthearing comment period. It addressed some of the questions raised by Dr. Anderson at the hearing as follows:

> The results of the strain gage tests during two and three 40 foot cargo container lifts carried out by LPI on November 1, 2004 at the APM Terminals Port Newark, NJ facility indicate that the strain rates that occur during VTL lifting are intermediate loading rates. Also, all of the maximum strains measured during the container lifts indicate that the stresses in the twist locks and corner castings are significantly less than the yield stress, Sy, that would be expected for the materials used in the twist locks and corner castings. [Ex. 65–3]

As noted by Michael Arrow, static testing is commonly used in the testing, design, and standardization of containers, and dynamic forces are accounted for using adequate safety factors (Tr. 1–55—1–56).[19] The Agency generally agrees with Mr. Arrow and believes that most dynamic forces can be accounted for by selecting an appropriate safety factor, by limiting the maximum load imposed on interbox connections during a VTL, and by limiting the wind speed during which VTLs are permitted. However, OSHA has concluded that dynamic forces should also be considered in the calculation of forces imposed during VTLs. Consequently, in determining the maximum safe working load for a VTL, the Agency has accounted for dynamic forces in two ways. First, OSHA has considered the lack of complete information on the dynamic forces imposed during VTLs in determining what an adequate safety factor is. Second, in calculating the maximum forces that the final rule allows to be imposed, OSHA has included forces imposed by accelerating the load during a lift and by the wind. In any event, the Agency does not believe that testing interbox connections to determine their strength under dynamic conditions, as suggested by Dr. Anderson, is necessary. Like the NIST and Swedish tests, dynamic tests would also be limited to existing twistlock designs and would likely be conducted on a small sample of existing designs to limit the cost of testing. Therefore, in using this two-fold method of accounting for dynamic forces, the Agency has adequately considered dynamic loads in setting the final rule and has concluded that further dynamic testing is unnecessary.

Determination of maximum safe loads. Guidance for calculating forces on twistlocks and corner castings in VTLs is presented in ''Vertical Tandem Lifting of Freight Containers,'' a paper authored by ICHCA International (Ex. 41). Appendix 4 of that document is a technical and engineering analysis of VTL operations. This analysis considered: lifting up to three containers vertically; the effect of wind speeds up to 100 km/h; and the forces involved in lifting containers of different sizes. The analysis assumed that all four twistlock-corner casting connections were fully engaged, assumed that a safe working load of 75 kN provided a safety factor of five based on the NIST and Swedish testing, and determined the safety of the lift based on the forces at the top corner castings of the top container in the lift.

OSHA will follow the ICHCA methodology in calculating forces imposed on interbox connections during VTLs, except that the Agency is substituting more restrictive assumptions about the capabilities of these connections. As discussed earlier in this section of the preamble, OSHA has determined that it is necessary to include the following conditions in the calculation of a safe working load for VTLs:

(1) The ultimate strength of the twistlock-corner casting connection is 490 kN (10,000 kg safe working load with a safety factor of five) as required by the final rule (the ICHCA analysis assumed that the ultimate strength was at least 375 kN);

(2) The safety factor is five as explained earlier in this section of the preamble (the ICHCA analysis also assumed a safety factor of five);

(3) The calculations must account for the dynamic loads imposed by lifting the load and the wind (the ICHCA analysis only calculated loads imposed by the wind); and

(4) Two twistlock-corner casting connections on opposite corners of vertically coupled containers are carrying the entire load (the ICHCA analysis spread forces across four fully engaged interbox connectors).

In addition, the Agency has concluded that the only connections to which this analysis should apply are connections involving SATLs. In other words, OSHA has only calculated the loads on fully engaged SATLs. As noted by the ILWU, the connection of the spreader bar to the top of the container

[19] Mr. Arrow called this ''static equivalency,'' in which higher loads are assumed than are actually expected to take place under static conditions. Thus, the higher forces caused by dynamic factors are accounted for by considering higher static loads.

is made through high quality, fully rated equipment specifically designed to lift containers and generally subject to the gear certification requirements of 29 CFR Part 1919 (Ex. 11–1B). The spreader bar to top container attachment must be capable of supporting its rated load in any single container lift. Loads imposed by VTLs on the top container's corner castings, the twistlocks on the spreader bar, and the spreader bar itself are no greater than the loads imposed in lifting a single container loaded to its maximum gross weight. Consequently, OSHA is not placing any additional limits on the spreader-bar-top-container connection beyond those imposed in lifting a single container. In other words, the total weight of the VTL lift must still be within the maximum load rating of the crane and spreader bar.

It could be argued that some factors that OSHA included in its strength analysis (that is, assuming that only two interbox connectors are fully engaged, that a force of acceleration equal to 2.0 g is applied (which is explained fully later in this section of the preamble), and that a maximum wind force of 100 km/h is imposed) should be accounted for by the safety factor rather than applying the safety factor after considering those factors. OSHA believes that its analysis is the correct one. The 2.0-g force due to acceleration will be present in every lift. The Agency believes that it is essential that the interbox connector-to-corner casting assembly be capable of withstanding this force within its rating (that is, before the safety factor is applied). Similarly, the effect of unengaged interbox connectors, which happens on a regular basis, must be accounted for in the rating of the system. If the analysis ignored those two factors, there would be little difference between the ultimate strength of the system and the expected load under very typical conditions. The remaining factor, the wind, could have been adjusted downward to match the maximum wind speed permitted under the standard. However, ICHCA used a 100-km/h wind speed in their calculations, and the difference in force between that imposed by the 55-km/h maximum wind speed allowed by the standard and the 100-km/h speed used in the analysis is relatively small. OSHA's conclusions on whether to require containers lifted in VTLs to be empty would be the same with either wind speed.

Under OSHA's analysis, the safety factor accounts for other unplanned, but not unexpected additional forces, such as those that could be caused by contact with obstructions during movement of the VTL (see 1998–Tr. 206—207). For example, if the VTL contacted an obstruction during descent and then slipped off that obstruction, there would be an additional force caused by the deceleration of the containers as the slack in the load line was taken up. The safety factor also helps counteract failures in work practices necessary to comply with the final rule. For example, a defective interbox connector might be missed during inspection, or employees might have failed to determine that a loaded container was not empty. Thus, the Agency has determined that its analysis takes a reasonable, and not overly conservative, approach to calculating forces during a VTL.

In addition, OSHA's analysis looks only at the connection between the top and bottom containers. This approach is less conservative than the approach taken in the ICHCA analysis, which examined forces at the connection between the top container and the spreader bar. OSHA's analysis considers only the forces in play where there is a concern about the adequacy of the devices used to support the load (that is, the interbox connectors and corner castings). ICHCA's analysis examines the strength of devices that might sustain even greater forces during single-container lifts.

For these reasons, the Agency believes that its approach is reasonable and not overly conservative.

To perform the calculations used in the analysis, OSHA must first determine the magnitude of forces due to acceleration from lifting the load and due to the wind. Lucius Pitkin measured the acceleration that occurs during a VTL and included the results in its report (Ex. 65–3). The findings show that the maximum acceleration resulting in tensile forces in the twistlocks is approximately 2.0 g.[20] The force imposed by this acceleration is given by the following formula:

$$F = m \times a$$

Where:
F = force,
m = mass of the load, and
a = acceleration.

This force is in addition to the weight of the load.

The forces imposed by the wind can be calculated using the American Bureau of Shipping formula, as was done in the ICHCA paper (Ex. 41):

$$F_W = 0.6203 \times C_H \times C_L$$

Where:
F_W = force caused by the wind (in kN)
C_H = container height
C_L = container length.

This formula assumes a wind speed of 100 km/h, which is higher than the 56 km/h permitted by the final rule. (The maximum permitted wind speed is discussed later in this section of the preamble.) The ICHCA paper performed its calculations with a wind speed of 100 km/h, which OSHA has determined is appropriate. This accounts for unanticipated wind gusts substantially above the maximum permitted wind speed. Paragraph (g)(3) of § 1917.45 requires rail-mounted bridge and portal cranes located outside of an enclosed structure to be fitted with an operable wind-indicating device. OSHA believes that employers will generally rely on these devices or on weather reports to determine wind speed. Because their settings are based on manufacturers' recommendations, the warning devices may be set higher than the maximum wind speed allowed for VTL operations. In addition, weather reports may not always include maximum wind gusts. Consequently, OSHA believes that VTLs may experience higher actual wind speeds under real-world conditions than permitted by the rule. Furthermore, calculating forces based on a higher wind speed than permitted by the final rule will help account for any dynamic forces imposed by the wind that are in addition to the calculated static force.

The force from the wind on the containers being lifted is assumed to be perpendicular to the length of the containers. This results in the maximum force. This horizontal force must then be converted to the vertical tensile force on the interbox connection using moment arms.[21]

OSHA is performing the calculations assuming a 12.2-meter, high-cube container equivalent to case I in the ICHCA paper (Ex. 41).[22] This case represents the worst general scenario for lifting more than one container at a time. Each of these containers is 12.2 meters long, 2.44 meters wide, and 2.90 meters high.

The ICHCA paper calculated the worst-case wind force with all four connections intact. However, as noted previously, OSHA is assuming that only two connections diagonally opposite each other are intact. Thus, OSHA's calculations must double the force on each connection (as calculated in the paper) because there is only one

[20] g represents the constant acceleration of gravity, or 9.8 meters per second squared.

[21] A moment arm, which is also known as a lever arm, is the perpendicular distance from the center of rotational motion to the line of application of force.

[22] Container sizes are typically characterized, in part, by their length in English units. Standard container lengths are 6.1 and 12.2 meters, and the containers are known as 20-foot and 40-foot containers, respectively.

connection on the windward side. In addition, OSHA is only concerned with the contribution of the wind on the connection between the topmost container and the next container down. This is equivalent to the force imposed by the top container in a two-container-high VTL. The ICHCA paper calculated the force on each of the top two windward connections as 6.5 kN. Consequently, under OSHA's assumptions, the force on the single windward connection between the top container and the bottom container is 2×6.5, or 13.0 kN.

The force of the wind on the connections must be added to the weight supported by each connection. The maximum tare weight (the empty weight) of a container is 4.5 metric tons, which results in a force of 22 kN in each connection. However, as noted earlier, this weight is accelerated during a VTL, with a maximum of 2.0 g of acceleration. The force from this acceleration must be added to the force due to the wind and the force due to the weight of the container to determine the baseline force on each of the two intact connections between the top container and the bottom. Thus, the total maximum force imposed by an empty bottom container on each interbox connection is $13.0 + 22 + (2 \times 22)$, or 79 kN. Applying a safety factor of five to this figure yields 395 kN.

Thus, the interbox connections must have an ultimate strength of at least 395 kN to account for an adequate safety factor for the heaviest empty container. This leads OSHA to the following conclusions:

First, the Agency must ensure that interbox connections have an ultimate strength at least equal to this value. Therefore, OSHA has concluded that the proposed requirement for a minimum safe working load of 10,000 kg with a safety factor of five (490 kN) is reasonably necessary and appropriate.

Second, as discussed in more detail later in this section of the preamble, the Agency has decided to limit VTLs to empty containers only. Although lifting VTLs with a maximum load that imposes a tensile force of 98 kN (equivalent to the 10,000-kg safe working load) on interbox connections of the required ultimate strength would yield a safety factor of at least five, OSHA has concluded that, without separately weighing the containers, there is no ready and reliable way to determine the weight of the bottom container and its load during VTL operations. In addition, OSHA believes that the difference between the 79-kN force arising from the tare weight of the container and 98 kN is too small to permit even the lightest loaded containers to be lifted. With the heaviest containers, the maximum load that could be safely lifted in a VTL is only 12.7 kN, or a little more than 1295 kg (1.25 tons).[23] Although it might be possible to select lighter containers with full loads that provide a sufficient margin of safety, there are other reasons why the final rule does not permit lifting loaded containers in a VTL, as described in more detail later in this section of the preamble.

Conclusion. OSHA had proposed to allow VTLs of two containers with a maximum load of 20 tons using twistlocks with a safe working load of 10,000 kg. The proposal was based primarily on data provided by NIST that twistlocks and corner castings were sufficiently strong to lift containers connected vertically in tandem safely. Based on evidence submitted during the rulemaking, OSHA has concluded that:

(1) The NIST study does not adequately represent the strength of all current twistlocks or of twistlocks designed in the future;

(2) It is not uncommon for one or more interbox connectors to be disengaged during VTL operations; and

(3) Existing analyses performed by the ISO technical committee and ICHCA do not fully consider loads imposed by acceleration or the consequences of the previous two factors.

OSHA has performed its own rigorous engineering analysis based on evidence in the record, as described previously, and has concluded that VTLs are safe provided that the interbox connectors have a minimum load-bearing surface area of 800 mm^2 and a minimum safe working load of 10,000 kg with a safety factor of five and provided that the containers are empty.

1. Two-container or Three-container VTLs

OSHA proposed to allow VTLs of no more than two ISO series 1 containers, with a total weight (containers plus cargo) of up to 20 tons. However, ISO standards and ICHCA guidelines on VTLs would allow up to three containers with the same total weight. In its proposal, OSHA requested comments on whether three-container VTLs of up to 20 tons could be handled as safely as two-container VTLs with the same weight limitation.

[23] This is calculated as follows: (98 - 79) * 2/3) = 12.7 kN. The total additional force would be triple the force from gravity alone because of the force from accelerating the load. Consequently, the allowable additional force would be one third of the extra force due to weight alone. In addition, the additional force would be spread over two interbox connectors, so the total additional force would be double that for a single interbox connector.

Several rulemaking participants recommended that three-container VTLs be permitted by the final rule (Exs. 43–7, 47–1, 47–2–1, 47–5, 54–2; Tr. 1–49, 1–76, 1–109). Several pointed to international standards and the ICHCA guidelines as evidence of the safety of three-container VTLs (Exs. 47–1, 47–2, 47–2–1, 50–10–1). Others pointed to international experience with three- and even four-container VTLs (Exs. 47–1, 47–5, 50–10–1, 50–10–2, 54–20). For example, in his prepared testimony for the 2004 public hearing, Mr. Ronald Signorino, representing USMX, stated:

> OSHA has proposed a regulation that limits a VTL unit to two container tiers. The agency has attempted to [buttress] such a limitation by stating that practical VTL experience in the United States is confined to the two container tiers. This simply does not address the issue that operationally three container tiers are handled in VTL configurations efficiently and safely elsewhere in the world. [Ex. 50–10–1]

Other arguments for allowing three-container VTLs concerned the strength and durability of containers, corner castings, and interbox connectors (Exs. 43–7, 47–5, 50–12). These comments have been addressed earlier in this section of the preamble. OSHA's conclusions on the issue of whether to permit three-container VTLs are based, in part, on an analysis of the strength of containers, corner castings, and interbox connectors. It is clear from this analysis that the corner casting-interbox connector assembly does not have sufficient strength to perform three-container VTLs safely. The analysis shows that the maximum force on either of the two corner casting-interbox connector assemblies is 98 kN. A two-container VTL imposes a force of 79 kN on each assembly. The addition of a third container would roughly double this amount to 158 kN, far exceeding the 98-kN limit to achieve a safety factor of five.

However, OSHA has not decided to limit VTLs to two containers simply based on insufficient strength. The Agency has weighed the evidence in the record and has concluded that, even if the system were strong enough to perform three-container VTLs safely, other factors make three-container VTLs too hazardous.

According to some witnesses at the 2004 pubic hearing, as VTLs increase in size and weight, there is greater potential for helicopter effects during crane operations. This effect can cause the containers to spin out of control because of wind lift or uneven loading or both (Tr. 1–119, 2–350—2–351). The witnesses explained that, as loads get larger, they become more difficult for the crane operator to control when moving or landing the load. For example, under questioning from an OSHA representative, Mr. Michael Bohlman explained why ICHCA limited VTLs to three containers at a time as follows:

MR. MADDUX: Yes. What I'm hearing is, when you went from three to four containers, that you had more sway.

MR. BOHLMAN: Well, you have a less compact, harder unit to control because it's bigger.

* * * * *

MR. MADDUX: As the bulk gets bigger, it gets more difficult to control, more difficult to land.

MR. BOHLMAN: * * * It's just [the] size, the effect of external forces, the pendulum effect that gets greater as the size gets bigger. [Tr. 1–119]

Mr. Jerry Ylonen, testifying on behalf of the ILWU, stated that he had experienced the helicopter effect firsthand and noted that it introduces such hazards as swinging the load into an adjacent bay or into a truck waiting for a load being lowered, endangering employees working in the bay or the truck driver sitting in his or her cab (Tr. 2–350—2–351).

OSHA has concluded that the risk of employees being seriously injured by these hazards is significant. Mr. Ylonen testified to the presence of these hazards in single container lifts and argued that two- and three-container VTLs would be catastrophic (Tr. 2–351). With a wind speed of 100 km/h, the wind force on two containers connected vertically would be a maximum of 43.9 kN. On three containers connected vertically, it would be a maximum of 65.8 kN. The sideways force on a three-container VTL would thus be 50 percent greater than the sideways force on a two-container lift. Based on the testimony of Mr. Ylonen and the substantial side forces on the containers during VTLs, OSHA believes that three-container VTLs would not provide a sufficient margin of safety from the helicopter effects of the wind.

In addition, transporting stacked containers around terminals presents tipover hazards about which several hearing participants expressed concern (Tr. 2–227, 2–283, 2–424). There is evidence in the record that tipover accidents have occurred in the past (Tr. 2–295, 2–358—2–359). Three-container VTLs would likely entail transporting containers stacked three high during VTL makeup. Because containers stacked three high would have a higher center of gravity, transporting them would pose a greater tipover hazard than transporting single containers or even containers stacked two high. Thus, OSHA is also concerned that permitting three-container VTLs would lead to an increase in the number of tipover accidents.

For these reasons, OSHA has concluded that the risk of serious injury to employees during three-container VTLs is too high, and the final rule does not permit such lifts.

Mr. Michael Bohlman, representing USMX, was concerned that the proposal did not specifically address tiers of containers in a VTL (Ex. 50–10–2; Tr. 1–75). Instead, he noted, the proposal limited VTLs to two containers. Mr. Bohlman testified on this point as follows:

One of the concerns that I have, reading the OSHA proposed rule, is that OSHA does not talk about tiers, but talks about numbers of containers. Regardless of whether it's two or three containers that they decide is the right number, if they don't talk about tiers of containers, there's going to be confusion as to what's actually meant.

When we start looking at unique spreader configurations that are in existence and are being safely used such as a twin-lift spreader that would allow, in a two-container configuration, a four-container VTL lift, or in a three-container, three-tier configuration, a six-container lift.

So I think it's very important that, when we do have the final rules, that they talk about tiers of containers being lifted and not number of containers. [Tr. 1–75]

OSHA's analysis of the safety of VTLs is based on the capability of two single containers connecting vertically to maintain a safety factor of five during lifting. As long as the tiers are lifted so that each set of two vertically connected containers is not connected to the other containers, then each vertically connected pair will be considered as separate VTLs for the purpose of the final rule. Therefore, tiers connected in such a manner are permitted by the final rule.

However, if the containers in a tiered VTL are connected horizontally, then some of the assumptions made in OSHA's strength analysis would be invalid. For example, if the bottom tier of two two-container VTLs is connected horizontally, then it would be possible for fewer than two interbox connectors to be fully engaged for each VTL. The connection of the bottom tier of containers could mask, during the prelift, the possibility that only a single interbox connector is fully engaged for one of the sets of vertically coupled containers. This would overload the single interbox connector-corner casting assembly for that portion of the VTL. Consequently, OSHA would consider containers coupled horizontally as counting toward the maximum of two containers permitted in a VTL by final § 1917.71(i)(2). Therefore, tiers with horizontally coupled containers would be prohibited by the final rule.

2. Empty or Partially Loaded Containers

A related issue is whether the standard should set a limit on the gross weight of containers and their loads lifted in a VTL or require that only empty containers be lifted. The proposed standard, which was based on ISO standards and the ICHCA guidelines, would have limited VTLs to a combined weight for load and containers of 20 tons.[24] Some rulemaking participants argued that, if VTLs were to be permitted, then the final rule should require containers to be empty (Exs. 43–5, 44–1, 54–30–2). Other rulemaking participants supported OSHA's proposed 20-ton limit (Exs. 10–4, 10–5, 10–6, 36, 37, 47–2–1, 50–12, 54–1–1, 54–2, 54–3, 65–3). No one urged the Agency to adopt a substantially higher weight limit.

The ILWU and the ILA argued that lifting loaded containers in a VTL was unsafe (Exs. 43–5, 54–1, 54–30–2). The ILWU stated that inaccuracies in the paperwork describing the weights of loaded containers could lead to overloaded VTLs exceeding the crane's capabilities (Ex. 43–5). The ILA argued that it is likely that loaded containers will have errors in weighing and that overweight lifts would be attempted if loaded containers were permitted to be lifted in a VTL (Ex. 54–1).

As noted previously, a number of rulemaking participants, including the Institute of International Container Lessors, the Carriers Container Council, Inc., and the USMX, argued that VTL operations were safe up to a total load of 20 tons (Exs. 10–4, 10–5, 10–6, 36, 37, 47–2–1, 50–12, 54–1–1, 54–2, 54–3, 65–3). They reasoned that the lack of accidents (Exs. 10–5, 10–6) and the strength of containers, corner castings, and interbox connectors (Exs. 47–2–1, 50–10–2) demonstrate the safety of allowing lightly loaded containers to be lifted in VTLs.

As discussed previously, OSHA has concluded that the lack of injuries in VTL operations does not prove their safety and that the existence of a substantial number of incidents indicates the need to regulate VTLs to ensure that they are performed safely. Furthermore, existing experience in the U.S. is based on compliance with the Gurnham letter, which requires containers to be empty. In addition, OSHA's analysis of the strength of

[24] The ICHCA guidelines and ISO standards set a limit of 20,000 kg (22 tons, or 20 metric tons), slightly more than OSHA's proposed 20-ton limit.

containers, corner castings, and interbox containers shows that these devices are not capable of performing VTLs weighing 20 tons with a safety factor of five when only two interbox connectors are fully engaged. In fact, the analysis demonstrates that, with the heaviest containers, only an additional 1295 kg is available as load to ensure a safety factor of five.

OSHA also agrees with the ILWU and the ILA that errors in determining the weights of loaded containers could lead to overweight VTLs. Limiting VTLs to empty containers also protects against shifting or uneven loads, which could overload one of the corner casting-interbox connector assemblies.[25] Furthermore, permitting VTLs involving only empty containers helps ensure compliance, as it will be relatively easy to ascertain that a container is empty by visual observation. On the other hand, the weight of each loaded container would have to be individually measured to ensure the safety of a VTL of loaded containers.[26] For these reasons, the Agency has decided to limit VTLs to empty containers only.

B. Training

With respect to VTL operations, OSHA did not include specific training requirements in the proposed rule. However, existing Marine Terminals and Longshoring standards address crane operator training in §§ 1917.27(a)(1) and 1918.98(a)(1), respectively. Those standards require that only an employee determined by the employer to be competent by reason of training or experience, and who understands the signs, notices, and operating instructions and is familiar with the signal code in use, may operate or give signals to the operator of any hoisting apparatus.

As noted earlier in this section of the preamble, the International Safety Panel of ICHCA has established comprehensive guidelines that could potentially serve as a foundation for domestic and international VTL operations (Ex. 41). The guidelines stipulate that ''all persons connected with VTL operations, including planning, examining, inspecting, stacking, transporting, hoisting, landing, securing and dividing containers handled in VTL units, should be appropriately trained.'' They require that ''the extent and content of such training should be guided by the physical characteristics of the terminal and the containers to be handled, the container movement flow, the equipment to be used for lifting and transporting the containers and the experience of the personnel involved.'' Many rulemaking participants supported the ICHCA guidelines and recommended that OSHA's standard be consistent with them (Exs. 43–6, 43–7, 50–10–2, 50–10–3; Tr. 1–239).

In the notice of proposed rulemaking, OSHA solicited comments on training—taking into consideration international standards and current domestic practices—that may be necessary for safe and efficient VTL operations. Rulemaking participants largely supported mandatory training for selected trades or positions affected by VTL operations (Exs. 43–7, 43–10, 44–1, 54–16). In fact, most rulemaking participants addressing the training issue reflected the need to train *all* persons involved in VTL operations (Exs. 43–10, 44–1, 54–16).

''The ILA deems it essential for its members and others in ILA ports to be trained in the techniques, risks and safety measures involved in VTL lifts and in assembling/disassembling VTL-connected containers,'' Herzl S. Eisenstadt stated (Ex. 44–1). ''This must include simulated training in handling emergencies caused by near-misses, sudden disengagements, etc., which are not identical for those occurring while handling single-lift containers,'' he elaborated.

Christine S. Hwang, appearing on behalf of the ILWU, agreed with the majority view that specialized training needs to be conducted for all job classifications, urging that ''specialized training on VTL operations be mandatory for all port workers in all classifications, including the casual labor pool'' (Ex. 43–10). Ms. Hwang went on to say that ''port-wide training should be required irrespective of whether a terminal employer in any given port chooses to perform VTLs in light of the fact that workers may travel to ports where they are required to perform VTL container operations.''

Taking into consideration these comments from rulemaking participants, OSHA agrees with the mainstream recommendation that some VTL-specific training is not only appropriate—but indeed necessary—for operation and employee safety in all U.S. marine terminals where VTLs are performed. However, the Agency believes that the depth of this training should be determined by employers based on individualized terminal criteria, rather than on a defined directive that inhibits customization. Therefore, OSHA has included a performance-based requirement for the employer to provide training for each employee involved in VTL operations. This provision requires the training to be commensurate with the employee's duties.

Beyond the consensus on widespread training, rulemaking participants voiced their opinion on further training specifics, such as to whom VTL operation training should apply and how extensive that training should be. Broad areas of discussion included training for preparation and performance, inspection and container integrity, ground movement, and work zone safety. The following sections summarize comments relevant to those topics.

1. Preparation and Performance

One example of possible procedural differences in performing VTLs is the operation of cranes to hoist the stacked and connected containers. Historically, VTLs have been performed by crane operators without off-site training specific to VTLs. Some rulemaking participants expressed the view that crane operator training is considered a crucial component to safe VTLs (Ex. 43–10).

Commenting on behalf of the ILWU, Hwang concurred as follows, ''Supplementary training (other than on the job) on special VTL handling should also be mandatory for crane operators.'' If a rule is adopted, ''ILWU strongly urges that various terminals' plans be standardized * * * and that crane operators be provided with additional training on how to read them,'' she continued (Ex. 43–10).

Mr. Joseph Curto, representing Maher Terminals, stated that VTL handling is one component of Maher Terminals' general training program (Tr. 2–117). Ron Hewitt of APM Terminals testified that his company also provided training in VTL procedures (Ex. 61; Tr. 2–208—2–210). He also recommended terminal-specific indoctrination (Tr. 2–208—2–209).

The ILA considered training in VTL procedures to be essential, as follows:

> In this regard, the ILA deems it essential for its members and others in ILA ports to be trained in the techniques, risks and safety measures involved in VTL lifts and in assembling/disassembling VTL-connected containers. This must include simulated

[25] OSHA's analysis assumes a uniform weight distribution. If the weight of the container and its contents are not uniform, more of the force could be concentrated on one of the two corner casting-interbox connector assemblies, perhaps overloading it.

[26] Since OSHA's strength analysis is based on the capability of the corner casting-to-interbox connector-to-corner casting assembly between the containers, the weight of the bottom container determines whether the VTL is safe to lift. By this analysis, the bottom container would be limited to a maximum of 98 kN, and the employer would have to measure the weight of the bottom container by itself to ensure that the VTL was safe to lift.

training in handling emergencies caused by near-misses, sudden disengagements, etc., which are not identical for those occurring while handling single-lift containers. [Ex. 44–1]

2. Inspection and Container Integrity

Another aspect rulemaking participants considered was the twistlocks themselves (Exs. 43–7, 54–30–2). The condition and proper operation of interbox connectors are more important for safe VTL operations than for connecting containers for transport aboard ship.

For example, APM Terminals' training program covers the examination of interbox connectors (Ex. 61; Tr. 2–153—2–154).

Though not thoroughly supportive of a specific OSHA requirement for training every worker involved in VTLs, Mr. Ronald Signorino, president of The Blueoceana Company, Inc., stated that training specific to interbox connectors would be advisable (Ex. 43–7). Mr. Signorino advised that mandatory training for personnel carrying out inspection-program-related functions was vital especially since he supported a continuous inspection program rather than an annual one. ''In that manner, all such liftlocks would be subject to more than just an annual examination and an occasional perfunctory perusal,'' he stated.

Mr. Le Monnier of ILWU Canada also provided testimony about the scope of inspections he thought OSHA should require, stating: ''A true inspection would require the dismantling of the SATL in order to view the internal components. Then, the SATL would need to be properly reassembled. Both the inspection and reassembly would require training procedures'' (Ex. 54–30–2).

The ILWU emphasized the point that adequate inspection of containers would also require training (Ex. 43–10–3). ''Only the obvious wrecks are likely to be identified by the average longshore worker, whose business it is to move the container, not subject it to rigorous inspection. Adequate inspection requires training, technology and ample time to accomplish such an inspection,'' the ILWU representative explained.

3. Ground Movement

The ICHCA guidelines (Ex. 41) specifically address concern for training of drivers of vehicles used to transport VTL units. The language dictates that:

> training of drivers of vehicles etc. used to transport VTL units should be based on the organization's safe operating procedures. These should place particular emphasis on the speeds at which the vehicles enter turns, in order to avoid overturns and other accidents. Assessing the effect of wind speed on equipment stability and imposing a maximum wind speed above which the movement of VTL units will not take place. This speed should not be more than 15 m/s (55 kph, 34 mph or 30 knots). [Ex. 41]

The guidelines take a direct approach by stating in paragraph 7.6, ''all persons expected to be involved in VTL operations should be suitably trained.''

4. Safe Work Zone

Again, the ILWU was among the strongest supporters of widespread training to ensure a safe work zone for those directly and indirectly involved in VTLs (Ex. 43–10). Specifically, Ms. Hwang suggested that training topics should include, but not be limited to, ''safe handling of VTLs, emergency handling, cone and SATL inspection and maintenance, operation of all vehicles used to transport VTLs and particular concerns unique to transporting VTLs, methods of verifying weights of containers and reading vessel stowage plans.''

As stated earlier, most rulemaking participants addressing the training issue were firmly supportive of a practice that requires workers performing or supporting the performance of VTL operations to receive training applicable to their assigned duty. The opponents of the VTL process suggested a wide, scattergun-type of training requirement, presumably meant to train *every* worker (in any marine terminal or longshore work category) regarding VTL aspects. (See Ex. 54–2.) OSHA considers such an approach to be ineffective and inefficient.

While an industry or port-wide approach to VTL training may be an option, it would be overly burdensome as an OSHA requirement. In its VTL Guidelines, the ICHCA Safety Panel formulated a training matrix that could serve to fill the gap between training for essential personnel and more widespread informational practices. In fact, Mr. Signorino, testifying on behalf of USMX, recommended that OSHA use the matrix (found in exhibit 41, Appendix 5) as a practical and useful guide (Exhibit 54–2).

OSHA is adopting a performance-based requirement for VTL training but has decided not to specify the exact scope, scale, and details of that training. OSHA will allow employers to determine how to best satisfy these requirements for safe VTL operations in their specific workplaces. The Agency strongly recommends, however, that employers examine the ICHCA recommendations (found on the aforementioned matrix; Ex. 41) as a foundation for training parameters. Based on criteria unique to each terminal and employee, employers should supplement the ICHCA guidelines as necessary to protect employees. Employers are cautioned to consider the need for specific training in the areas discussed above, as OSHA will judge compliance based on employee knowledge and skill at performing the job safely.

C. Crane Type

Within OSHA's final rule on VTL practices in Longshoring and Marine Terminals, the type of crane that can be used to perform VTLs is addressed in § 1917.71(i)(4). The Agency's final rule requires VTLs to be performed by shore-based container gantry cranes or other types of cranes that have similar characteristics as described in more detail in this section of the preamble.

In the proposed rule, the Agency limited the practice of VTLs in the Marine Terminals Standard [27] exclusively to container gantry cranes based on three premises:

1. The container gantry crane is the only type of crane specifically designed to handle intermodal containers;
2. The container gantry crane is the only crane that has the precision control needed for such lifts;
3. The container gantry crane is the only crane capable of handling the greater load volume and wind sail potentials.

(68 FR 54303)

However, because many rulemaking participants (Exs. 43–1, 43–11, 47–5, 50–10–1, 54–4, 54–5, 54–14) voiced significant opposition to a requirement specifying the type of crane that may perform VTLs, OSHA has amended the language in the final rule to permit other types of cranes meeting the aforementioned mandatory criteria. The final rule takes into consideration comments, testimony, and evidence submitted by the participants, including Liebherr-Werk Nenzing Crane Company, which offered evidence about the cranes the company manufactures that have the capability to handle VTLs (Ex. 54–15; Tr. 1–314).

The most extensive comments came from Mr. Ronald Signorino, testifying for USMX (Ex. 50–10–1), who disagreed with the Agency's position, reasoning that ''[its] sense is that OSHA has imposed a totally unnecessary restriction in that the proposed rule would limit VTL operations to those in which a container gantry cranes is

[27] OSHA did not propose a corresponding requirement for the Longshoring Standard.

present, [when] other lifting appliances may, in fact, provide the same attributes that, in their sum, lend themselves to a safe VTL operation.'' Mr. Signorino testified at length about other types of cranes that had the necessary capability for VTLs and submitted documentation to the record showing the capabilities and certifications of these cranes (Exs. 54–4, 54–14; Tr. 1–280—290). The following discussion summarizes Mr. Signorino's further comments, as well as those from other rulemaking participants, and explains the Agency's final determination on the issue.

1. Design

In the rulemaking process, crane manufacturers, terminal operators, shipping concerns, and other companies maintained that the container gantry crane was not the only crane that was specifically designed to handle intermodal freight containers or that had the necessary precision for VTLs (Exs. 43–1, 43–11, 50–10–1, 54–14, 54–5). USMX (Ex. 47–5) argued that ''there are other types of cranes * * * that perform in a manner similar to shoreside container gantry cranes and provide equivalent handling stability and safety.'' The association explained that ''other types of marine cargo handling equipment, such as reach stackers and straddle carriers, can [also] be utilized to conduct VTLs.''

These participants argued that cranes of different designs were capable of performing VTLs. Commenting on behalf of Tropical Shipping and Birdsall, Inc., Mr. Signorino (Ex. 54–14) used the Gottwald HMK 260 E as an example, stating, ''lateral stability is accomplished through the means of solid state electronic drives and an operator controlled, precision rotator ring.'' Mr. Signorino also cited the Manitowoc 4100 W (Series 2), stating ''[With this crane], such lateral stability is accomplished through a system of automatic lanyards that are attached to outriggers on either side of the box spreader. * * * In this system, undesired lateral movement is automatically compensated for in a unique take-up system of lanyards, which ensures lateral stability throughout the entire range of motion from ship to shore and vice-versa.''

Representing USMX, Mr. Signorino (Ex. 50–10–1) further stated

> Some, such as rubber tired gantry cranes, straddle carriers, and certain other high capacity industrial trucks, can in fact perform all hoist and (when applicable) gantry and trolley functions in an extremely stable vertical and horizontal plane. Others, such as purpose-designed container handling harbor cranes, are fitted with highly precise mechanical and hydraulic stabilizing equipment, which ensures the lateral and rotational stability so necessary to safely conduct VTL operations
>
> * * * * *
>
> I know the agency did not intend to be that restrictive, and I believe that language can be crafted to accommodate all container handling devices that can safely qualify for use in VTL operations. The goal, here, is to be cautious and deliberate not only in terms of safe working load design capacities, but also in lateral and rotational stability abilities, as well. [Ex. 50–10–1]

2. Control

Also important is the degree of precision with which a crane may be controlled. Mr. Signorino explained that:

> precision control of any crane engaged in the handling of intermodal containers is a very relative matter. * * * [S]ome cranes offer a more precise means and a more precise sense to operators. The better, more experienced operators tend to make more effective use of such attributes. * * * [T]he load is moved (whether in a hoist or lowering exercise) in a relatively straight, level plane. [Ex. 54–14, emphasis included in original document.]

He also elaborated on how the Gottwald's ''[j]oystick controls permit the operator to correct any unwanted lateral movement by a simple, incremental activation of the rotator.'' Mr. Signorino noted that container gantry cranes have sufficient precision to perform VTLs: ''[they] can offer that control, in part, by moving the load on a set, level track (or trolley).''

3. Capability

Finally, commenters discussed the overall capability of different cranes. Mr. Signorino (Ex. 50–10–1) advised: ''The real concern that OSHA should rightly consider is not a limitation in terms of actual lifting appliances, but rather, how to ensure the stability of the load (mass) notwithstanding the lifting appliance being used. * * * [T]he remaining concerns all center upon lateral and rotational stability of the mass.'' Mr. Signorino continued to explain that even though container gantry cranes have a proven track record, there are other cranes with the capability to safely perform VTLs. ''Container gantry cranes achieve * * * stability (when operated correctly) by their design characteristics, i.e., gantry, trolley, hoist functions, each moving in a relatively straight plane.''

4. Other Concerns

There were no specific comments from rulemaking participants calling for the exclusive use of shore-based container gantry cranes. In the same vein, there was no opposition to the container gantry crane being the preferred delivery method for VTLs. Rulemaking participants objected to the exclusivity and limitation to shore-based gantry cranes in the proposed rule on the grounds that it would hinder efficient operations (Exs. 43–1, 43–11, 47–5, 50–10–1, 54–4, 54–5, 54–14).

Beyond this general consensus on the proposed rule, there was some concern on other aspects of crane operation including aging infrastructure and load stability. As offered by Virginia International Terminals, Inc., represented by Anthony Simkus, Assistant Director of Engineering and Maintenance, and Charles Thompson, Safety Officer (Ex. 54–16), ''by factoring in age and condition, most older cranes probably could not stop an overload when the brake is applied at other than near zero speed. This may even be true of newer cranes whose brake designs have not been dynamically tested at the factory under rated conditions.''

Though in the context of testimony in overall opposition to the proposed rule on a variety of points, the USMX (Ex. 47–5) similarly agreed with infrastructure considerations, stating, ''VTL regulations must be written to accommodate future enhancements in current equipment as well as new equipment designs and technology.''

OSHA agrees with USMX's position that there are other types of cranes that perform in a manner similar to shoreside container gantry cranes and provide adequate handling stability and safety. The Agency has concluded that the criteria noted in Mr. Signorino's comments accurately describe the characteristics of cranes that can safely handle containers in VTL operations. Therefore, the language in the final rule will broaden the parameters contained in the proposed rule, stipulating the preference for shore-based container cranes, but allowing other types of cranes that (1) are verified to be designed to handle intermodal containers, (2) have the precision control needed for VTLs, and (3) are capable of handling the greater load volume and wind sail potentials associated with VTLs.[28] While this language allows for more discretion by employers, the Agency will judge compliance on the design, capability, and precision parameters, and it expects employers to evaluate cranes performing VTLs using these same criteria.

[28] As noted later in this section of the preamble, ship's cranes, because they are not shore-based, must meet the alternative criteria listed in final § 1917.71(i)(4).

D. Platform Containers

Proposed paragraph § 1917.71(f)(3)(iv) addressed platform containers, or ''flat racks,'' stating:

No platform container with its end frames erect may be lifted as part of a VTL unit. Empty platform containers with their end frames folded may be lifted in a VTL unit in accordance with the applicable regulations of this part. If the interbox connectors are an integral part of the platform container and are designed to lift other empty platform containers, they may be interlocked and lifted in accordance with the manufacturer's recommendations.

Platform containers are open on the wider sides and top, but have panels on the narrow sides, or ends. The end panels are either fixed in an upright position or folded flat with the floor of the container, depending on the design of the flat rack. The proposal would not have permitted flat racks to be used in VTLs if the end panels were in the upright position. The lack of sides and top lessen the strength and stability of the container, making it a possible safety hazard to lift them in tandem. However, if empty platform containers had the ends folded down and built-in connectors that were designed for the purpose of simultaneously lifting multiple units, the proposal would have permitted the flat racks to be handled in accordance with manufacturers' recommendations. Also in the proposed rule, two flat rack containers with the ends folded down could be handled as a VTL if they were connected by interbox connectors that were not built-in.

In a letter dated October 31, 2003, the ILWU contacted OSHA with flat rack concerns. Larry Hansen, ILWU Local 19 Union (Ex. 48), wrote to the Seattle OSHA field office:

We have a problem in Seattle of lifting empty flat rack containers bundled four or five at a time for both inbound and outbound loads. In some cases, the hoisting fits within the Gurnham letter where twist locks are being used to fasten one container to another. In other cases, the containers are fastened by internal mechanisms securing one container to another, which is outside the Gurnham provisions.

In dealing with the Gurnham provisions, the employers are not inspecting the containers for visible defects prior to hoisting, ensuring that damaged containers will not be hoisted in tandem as stated in Item 1 of his letter. Nor are we receiving documents from the manufacturer which verifies the capacities of the twist locks and corner castings, as stated in Item 7.

The Agency responded (Ex. 48–1) with the following comments:

Although the Gurnham letter does not specifically mention VTL lifts of [flat rack] containers, OSHA concluded that the provisions listed in the letter also apply to VTL lifts of two empty [flat rack] containers with their end frames folded and connected by semi-automatic twist locks.

Though the Agency received few comments on this issue during the rulemaking process, the ILWU was present to voice some further concerns regarding the lifting of flat racks vertically in tandem (Ex 43–10). Overall, the ILWU opposed the lifting of multiply stacked platform containers with end panels in the upright position; but the ILWU also strongly opposed the complete discretion afforded to users and manufacturers of platform containers with end panels folded down. The ILWU argued: ''There is no record or analysis regarding new or already existing connectors' strength, durability and/or capacity or of the corner castings of [flat racks].'' The union suggested that ''[t]he hoisting of multiply-stacked [flat racks] be prohibited in light of the absence of evidence demonstrating that this type of lift can be performed safely.'' The ILWU also argued that flat rack VTLs ''pose even greater problems [than container VTLs] due to the inferior quality of the corner castings.'' An ILWU representative (Ex. 43–10) explained that ''corner castings on [flat racks] are made from thinner metal and have larger openings through which SATLs and interbox connectors are even more likely to fall through, irrespective of whether they are adequately locked.'' The representative went on to say that flat racks ''endure even greater damage through wear and tear due to the fact that they are used to carry bulk cargo, which is often made of steel and hard materials.''

During the rulemaking period, the ILWU went on to cite numerous incidents when flat racks have proved hazardous (Ex. 43–10; Tr. 2–369–2–370, 2–419–2–420). According to the ILWU (Ex. 43–10), ''on November 14, 1997 in Tacoma, Washington, four stacks of [flat racks] were [bundled] together and connected by the cones that are built into the [flat racks] and by Evergreen SATLs. The [flat racks] were also banded together. When the bundle of [flat racks] was hoisted, the bands broke, the cones failed and the bottom [flat racks] fell approximately sixty to seventy feet.'' Mr. Ross Furoyama, an ILWU representative (Tr. 2–419–2–420), pointed out that among the unspecified number of incidents he had witnessed involving flat racks failing, there was one when the bands around three stacked flat racks secured with 2-inch bands and specialized nonstandard twist locks still broke. Following this incident, the company instituted a ''prechecking'' policy. Employees were then required to prelift the stacked flat rack bundles before hoisting them, to make sure they were properly connected. After implementing the precheck procedure, the bands continued to break, so the company started using chains to secure the bundles. Mr. Furoyama remained dubious about the safety of the procedure.

Other rulemaking participants supported allowing platform containers to be lifted in VTLs (Exs. 10–2, 52–3; Tr. 1–57). Mr. Michael Arrow of USMX supported lifting flat racks in VTLs, stressing that ''ISO Standard 1496.5, Section 7.3, clearly indicates that [flat racks] not only may be lifted in a stacked pile, but are specifically designed and tested to be able to do so'' (Tr. 1–57).

Another proponent of flat racks, Domino Flatracks, attempted to support its views with data on existing platform containers (Ex. 52–3). Domino Flatracks stated that ''there are 80,000 Domino [flat racks] in service and several thousand platforms using these twist locks, some of which have been in service for more than 24 years.'' Domino's representative went on to say that ''the assembly successfully held the design loads of both 15 and 30 tons and is thus concluded to satisfy the customer requirements.'' Nevertheless, the company was also quick to point out that assembly failure did occur at 38 tons (Ex. 52–3). As noted earlier in this section of the preamble, the Agency has concluded that a safety factor of five is reasonably necessary to ensure the safety of VTLs, and OSHA considers the margin of safety noted in the Domino Flatrack comments to be insufficient.

After carefully considering all the materials in the record on flat racks, OSHA has determined that flat rack corner castings and connectors are inferior to corner castings on standard containers and interbox connectors required for use in VTLs in the final rule. The Agency has therefore concluded that flat racks should not be considered appropriate elements of safe VTLs in marine terminals. The anecdotal evidence of flat rack VTL failures indicates that lifting bundles of flat racks connected solely by interbox connectors is unsafe. The comments of Domino Flatracks, a platform container manufacturer, suggests a simple explanation of why these failures have occurred: these devices simply do not offer a sufficient factor of safety to ensure a safe VTL. Further, the evidence that the corner castings and interbox connectors do not match the standardized types used in ISO Series 1 containers indicates that OSHA strength analysis is not applicable to flat rack VTLs. Consequently, in the final rule, the Agency is banning the practice of lifting flat racks connected by built-in connectors or by separate interbox connectors. Employers may still lift multiple flat racks in bundles by following §§ 1917.13 and 1918.81 for unitized loads.

E. Coordinated Transportation

The safe transport of vertically connected containers in marine terminals was largely addressed in the proposed rule in paragraphs § 1917.71(i) and § 1917.71(j). These paragraphs address the communication, equipment, and operational parameters required for safe transportation practices during VTLs.

OSHA believes that these two provisions, as they were introduced in the proposed rule, could substantially reduce the risk of injuries related to VTLs, and therefore has carried them forward into the final rule largely unchanged as § 1917.71(j)(1) and (j)(2). The requirements expressly stipulate:

1. Equipment used to transport vertically connected containers must be either specifically designed for this application or evaluated by a qualified engineer and determined to be capable of operating safely in this mode of operation.

2. The employer must develop, implement and maintain a written plan for transporting vertically connected containers in a terminal. The written plan must establish safe operational parameters, such as optimal operating and turning speeds; as well as address any other conditions in the terminal that could affect the safety of the movement of vertically coupled containers.

A safe, organized transport plan also involves communication and coordination among all affected employees. To coordinate transportation efforts in Marine Terminals, proposed paragraph § 1917.71(b)(9) would have required that a copy of the vessel cargo stowage plan be given to the crane operator and that the vessel cargo stowage plan be used to identify the location and characteristics (that is, weight and content) of any containers being used in a VTL.

As explained in detail later in this section of the preamble, the Agency has decided that existing requirements in § 1917.71(b)(1) and (b)(2)(ii), which mandate that the gross weight of containers be marked or a stowage plan be available, are not sufficient for safe VTL operations; therefore, the final rule does not carry forward proposed paragraph (b)(9). As the final rule only permits VTLs with empty containers—and requires employers to verify that each container in a VTL is empty before it is lifted—OSHA has concluded that requiring the stowage plan to be provided to the crane operator and for the plan to be used to identify containers lifted in VTLs is redundant, and therefore unnecessary.

The following is a summary of the rulemaking comments that prompted OSHA to arrive at the final rule's provisions related to transport safety.

1. Equipment

Paragraph (i) of proposed § 1917.71 would have prohibited the movement of VTLs on flatbed trucks, chassis, bomb carts, or similar types of equipment, unless the equipment was specifically designed to handle VTLs or evaluated by a qualified person (defined in proposed § 1917.71(i) as ''one with a recognized degree or professional certificate and extensive knowledge and experience in the transportation of vertically connected containers; also one who is capable of design, analysis, evaluation and specifications in that subject'') and determined to be safe in this mode of operation.

This section of the proposed rule met with support, as there was general apprehension among rulemaking participants (Tr. 2–27) about moving tandem stacked containers around the terminal using unmodified chassis and bomb carts, due to a greater chance of vehicle tipover because of a higher center of gravity. Transporting two containers on such equipment can raise the center of gravity higher than the equipment was designed for, increasing the possibility of the vehicle tipping over (Ex. 41).

Rulemaking participants discussed a study that was conducted at the request of the ICHCA VTL workgroup, *Vertical Tandem Lifting of Freight Containers*, which evaluated the safe turning radius and speed at which VTLs may be moved in a terminal (Ex. 41). The study provided chassis stability calculations for determining the speed at which a fifth wheel and chassis carrying vertically coupled containers would tip over while making a turn.

Alternative examples, offered by Mr. Ronald Signorino of the Blueoceana Company, Inc. (Tr. 1–160), could also reduce the risk of vehicle tipovers to a safe level. Mr. Signorino stated that straddle-carriers, top-loaders, MAFIs, low-beds, and bomb carts are used to move containers around the terminal; but that personnel typically move vertically connected containers only a very short distance away from the crane and break them down using terminal industrial trucks.

Rulemaking participants also offered comments that were not specific to vehicles, rather more supportive of other equipment requirements as part of an overall safety program. ''[W]e have experienced tipover in Hawaii,'' said ILWU member Mr. Ross Furoyama (Tr. 1–211). ''[W]e did transport tandems on chassis and we did flip over.'' Though Mr. Furoyama did not offer a specific solution (except to ban VTLs altogether), some rulemaking participants argued that speedometers on transport equipment could further prevent tipovers and other accidents. For example, Daniel Miranda of the ILWU (2–339) testified that safety essentials, like speedometers, should be in place when transporting containers around the terminal because of the potential for accidents. ''Currently on the west coast, our employers have refused to provide [utility tractors], hustlers, with speedometers, a device that is so basic in controlling speeds within the terminals for the movement and transport of these VTLs,'' he explained (Tr. 2–339). ''Without this basic device and other necessary controls, the safe movement of VTLs within a main terminal is not possible. * * * Those controls must be mandated first before we even take it off the ship, on or off,'' he continued.

The lack of speedometers was important, Mr. Miranda (Tr. 2–358) testified, because accidents that have occurred could be attributed to excessive speed. These incidents prompted Mr. Miranda to stress that a transport plan should be developed because of the speeds in the yard (Tr. 2–358).

The Agency has concluded that it is not necessary to require speedometers in the final rule. Though OSHA agrees that speedometers can be useful for equipment operators, it does not consider them the only precautionary measure to be taken during ground transportation. For instance, as Mr. Signorino pointed out, vertically connected containers are typically moved very short distances away, and there are other vehicles—vehicles that may not be equipped with speedometers—capable of performing the transport (Tr. 1–174). In terminals such as those Mr. Signorino referred to, speed would not be a prime safety factor to prevent potential accidents. The Agency considers speed to be of lesser consequence if transporting the vertically coupled containers does not require turns or involve uneven ground surfaces. However, as noted later in this section of the preamble, OSHA does not believe it to be appropriate to impose speed limits in an employer's transportation plan for vehicles that do not have speedometers. For these vehicles, the transport plan must include other measures to ensure the safe movement of vertically coupled containers.

2. Operational Parameters—Transport Plan

Operations before, during, and after VTLs all create an environment with potential for injury. Proposed paragraph (j) of § 1917.71 would have required that a written transport plan be developed and implemented to include safe operating speeds, safe turning speeds, and any conditions unique to the terminal that have the potential to affect VTL-related operations. In the notice of proposed rulemaking, OSHA asked for comment on what information should be in the terminal VTL handling plan and which safe practices would be necessary to ensure safe transport of stacked containers via ground transport.

Rulemaking participants supported the proposed requirement and gave reasons to develop a written plan for transporting containers around the terminal. Herzl Eisenstadt of the ILA (Ex. 47–3) described his concern saying: ''It is quite possible that even the ground-handling aspects have been susceptible to danger-laden incidents in preparing for and transporting VTL-lifted containers. In any and all events, the terminal plan must provide for carefully laid-out coordination of ground and lift operations that emphasize *safety first* for all terminal personnel in the vicinity of VTL operations.'' (Emphasis included in original.)

The support for a written transport plan notwithstanding, participants did ask OSHA to remain cognizant of the unique characteristics within each terminal as it moves forward with the VTL standard. Mr. Michael Bohlman of Horizon Lines (Tr. 1–196–1–197) testified that though turning radius, weight distribution, and speed studies have been conducted, each terminal needs to be looked at within its individual context before any safety requirements are set for that terminal. James M. McDonald, Vice President for Accident Prevention of the Pacific Maritime Association and Secretary to the Board of the Directors of the National Maritime Safety Association, subscribed to the same logic and called for rational and nonrestrictive regulations that will safely cover transport of VTLs in general. Mr. McDonald believed that ''[t]he rules as written now basically outline that [employers] have to provide for safe movement of the containers on the terminal'' and that everybody needs to have a plan with respect to VTLs, so that everybody will know their roles and be trained for their roles, and VTLs can be done with the utmost safety (Tr. 2–159).

As stated earlier in this section, OSHA has decided not to change the provisions proposed in paragraphs (i) and (j) substantively in the final rule; however, the Agency reminds employers that they must consider all aspects of transporting vertically coupled containers that affect safety, including the relevant factors discussed in this rulemaking.

For instance, the ILWU and some other rulemaking participants (Exs. 43–10, 44–1, 47–3) recommended that the Agency supplement its proposed rule with some of those rules implemented by Section 8.1.12 of ICHCA's *Vertical Tandem Lifting of Freight Containers* and Section 16 of the *Pacific Coast Maritime Safety Code* (PCMSC). These documents contain mandates for transporting vertically coupled containers, such as requiring workers to wear protective gear (high visibility vests) and prohibiting truck drivers from cutting across designated driving lanes. The ILWU argued that ''movement of VTLs throughout the terminal will be equally, if not more precarious than [VTL hoisting],'' and urged OSHA to consider supplementing the proposed rule to require additional terms (Ex. 43–10).

The union maintained that standardized transport plans for all ports were preferable, but it also recommended a minimum of the following provisions: regulated safe surface road conditions; additional safety manning for VTLs throughout the terminal; posted speed limits and stop signs for VTLs; speedometers, wind alarms and LIDs for every vehicle used for moving VTLs; and additional and designated special safety lanes for vehicles transporting VTLs (Ex. 43–10).

Though OSHA feels these suggestions could assist employers in establishing individualized transport procedures that would enhance port safety with specialized considerations, the Agency has decided not to adopt the ICHCA or FCMSC provisions. OSHA considers the provisions to be inappropriate for some workplaces and thus to be too restrictive. The final rule, instead, requires employers to tailor their transport plans based on performance and conditions specific to their workplaces. For example, if transporting vehicles are equipped with speedometers, speed limits could be set. On the other hand, if speedometers are not present, employers must take other measures to ensure stability—such as prohibiting turns or otherwise ensuring that tipovers are not possible. Similarly, if roadway conditions present uneven areas or large potholes, the employer must set slower speeds than would otherwise be possible on uniformly level surfaces.

3. Operational Plan—Communication and Coordination

As stated earlier in this section of the preamble, proposed § 1917.71(b)(9) would also have required additional safe operational parameters involving communication and coordination within the terminal and among terminal employees. This provision was taken directly from section 8.1.1.1 of the ICHCA guidelines.

The ILA, ILWU, Virginia International Terminals, NMSA, PMA, and the ICHCA guidelines stated that the potential hazards of VTL operations require close cooperation between all parties involved in the operations, including terminal operators, shipping companies, workers' representatives, and competent authorities, to ensure the development of safe procedures for the operations (Exs. 41, 43–10, 44–1; Tr. 2–24, 2–116—2–117). They also stated that such cooperation is necessary not only within container terminals but also between ships and their originating and destination terminals.

OSHA agrees with these commenters and has concluded that safe transport operations require communication and coordination among transport teams, crane operators, and other key terminal staff. If the lines of communication are not open to all involved parties, safe VTL operations can be jeopardized. The testimony and public comment the Agency received during the rulemaking process revealed that communication during VTL operations is very important. So important, in fact, that some participants felt the lack of communication could possibly be the ''weak link in the chain'' regarding the success of safely conducting VTLs (Tr. 2–61).

Many rulemaking participants provided ideas as to how to communicate to everyone that VTLs are going to be done on a particular day. Communication within the terminal about VTLs before they are conducted has aided some companies in ensuring a smooth series of VTLs. One such situation is at APM Terminals. Ron Hewett, APM's Director of Safety and Training, shared how this preparation has benefited them. He explained:

A pre-shift conference with APM Terminal supervisors and International Longshoreman's Association members provides an overview of VTL operations. This provides an opportunity for all personnel to fully understand the planned operation. communications, personnel involved, equipment to be used, procedures, and basic safety concerns are discussed. [Ex. 50–13]

Mr. Thompson, representing Virginia International Terminals, pointed out that ''the people factor is a concern,'' particularly if a terminal does not do a lot of VTLs (Tr. 2–61). ''If we consistently handle one container at a time, we have a safety margin. Those terminals [that] handle two and three consistently all the time are used to it, and have the precautions in place,'' Mr. Thompson said. ''Terminals of our size, and I believe there are some others on the east coast, but I can't speak for them, see it as a possible intermittent, and that intermittent action is probably going to be a source of miscommunications, injuries, and accidents'' (Tr. 2–20).

Examples of different procedures offered by participants to ensure adequate communication during VTL operations included:

- ''The vessel superintendent is the one that calls out standby for the vertical tandem lifts'' (Tr. 2–217).
- ''Prior to commencement of work on each hatch, trained crane operators are given direction on which containers and bays will be handled in [VTL] fashion'' (Ex. 50–13).
- ''[M]ostly in vertical tandem lifts, the crane operator knows that they cannot just go down and lower it full speed, and that is just the basic part. They count on the signalman, who coordinates this to give them the proper signals to prevent this from happening'' (Tr. 2–123—2–124).
- ''[B]efore the crane operator lifts, whether it is a semi-automatic, or a fully automatic, there is a process, something has to be done. Semi-automatic has to be unlocked, and fully automated, somebody is working on the deck to maybe do some latching rods, or some other cargo securing. Somebody will signal to him that it is okay now to start taking containers off'' (Tr. 2–192).
- PCMSC, 2002. Rule 1613—''Top/Side Handlers and Reach Stackers working together against that vessel shall also be assigned a separate radio channel from those assigned to the working cranes'' (Ex. 43–10–11).
- ''Foremen and supervisors coordinate with lashers and ground-men the identification and placement of Allset C5AM–DF Liftlocks in corner castings. This process ensures that all locks operate in the same manner and are placed correctly in corner castings'' (Ex. 50–13).

As mentioned earlier in this section, communication can present a weak link in an overall safe and coordinated VTL transport plan. OSHA agrees that the commenters' suggestions listed above can be useful tools for employers to use in developing their own tailored transport plans.

4. Operational Parameters—VTL Picking (Organization)

Preplanned and organized picking of VTLs minimizes much guesswork for workers in the terminal and on ship. In the proposed rule, OSHA aimed to minimize injuries by requiring, through the written plan, prearranged movement of VTLs.

The recommendations in PCMSC–2002 demonstrate that preparation at the terminal before a VTL and planning the movement of VTLs can significantly enhance safety (Ex. 43–10–11). ''Prior to commencement of work on each hatch, trained crane operators are given direction on which containers and bays will be handled in [VTL] fashion,'' said Mr. Ron Hewett (Ex. 50–13), providing an example of this type of preparation.

From OSHA's point of view, many of those involved with VTLs have used an organized approach to loading or unloading VTLs. This allows all employees to be on the same page and any safety precautions that need to take place are communicated to all working in the area. ''[Y]ou have a pretty good idea when you get the [stowage] plan from the port of departure and you know how the ship is configured, then you can plan the number of vertical tandem lifts you do when it hits the United States,'' said Maersk Captain Bill Williams (Tr. 2–127). Ron Hewett, representing APM Terminals, noted that ''the actual sequence and the team coordination will vary from gang to gang and terminal to terminal, but it is available to the crane operator'' (Tr. 2–216).

Planning ahead for VTLs aids in efficiency as well. As Captain Williams described, ''I think that * * * every terminal is unique in the way they operate and perform, and the way they're configured, and the ships that come in.'' Captain Williams explained that ''[t]he same ship may be different the next time it comes into the port, just based on the economic conditions.'' Captain Williams advised that advance notice is best, saying ''So there is really no hard and fast rule, except you have a pretty good idea when you get the plan from the port of departure and you know how the ship is configured, then you can plan the number of vertical tandem lifts you do when it hits the United States'' (Tr. 2–127—2–128).

Some participants felt that terminal uniqueness complicates a mandatory plan for the transportation of vertically coupled containers (Tr. 1–196—1–197, 2–158). The National Maritime Association's Mr. McDonald explained that ''each individual terminal operator working with their company policies and their terminals, which are all unique, have to build their VTL plans within the guidelines that OSHA will come out with'' (Tr. 2–158).

While OSHA agrees that each terminal's unique characteristics contribute to the complexity of developing plans, the Agency still feels a sound transport plan with all of the three discussed components—coordination and communication among all affected employees, appropriate equipment, and proper operational parameters—will help ensure the safety of terminal employees. Additionally, such a cohesive plan will ultimately enhance productivity. Therefore, OSHA has carried the proposed requirement for a transport plan forward into the final rule. Employers are advised to take all conditions unique to their terminals into consideration, while adhering to the requirements of final § 1917.71(j)(2).

F. Safe Work Zones

OSHA noted in its preamble to the proposal that employees working around VTLs are exposed to the risk of falling containers should the VTL fail (68 FR 54302). The current Marine Terminal and Longshoring standards recognize hazards inherent in working under suspended containers in existing §§ 1917.71(d)(2) and 1918.85(e), which prohibit employees from working beneath a suspended container. Evidence in the rulemaking record addressed the risks faced by employees working near VTL operations (Exs. 4, 10–5, 19, 43–5, 43–10–3; Tr. 1–319, 1–337—1–338, 1–374, 2–227—2–229, 2–359—2–361, 2–386).

Taking into consideration all participant comments, the Agency has decided to include language regarding safe work zones and landing and tipover footprints in its final rule. The final rule supplements the existing requirements that prohibit employees from standing under an elevated load by requiring, in § 1917.71(k)(1), employers to create a ''stand-clear zone'' from vertically connected containers in motion. OSHA is not requiring a designated place in each terminal where all employees are required to stand or a designated area where employees are prohibited while the connected containers are being handled by a crane or ground handling equipment. The final rule thus allows employers flexibility in determining how best to comply with the safe work zone requirement during VTL operations in their workplaces.

During the rulemaking process, OSHA requested that participants relate information about incidents involving vertically coupled containers that had fallen. Rulemaking participants, such as ILWU member Mike Freese, testified about current practices that put employees at risk. Mr. Freese described one incident where two containers were being lifted in an area that was supposed to be cleared, but he said ''I clearly saw people standing around the bomb carts. I saw another bomb cart pull up while people were standing there in the area'' (Tr. 2–386).

In addition to comments on the primary concern of employee fatalities and injuries, the Agency heard testimony on near misses; as well as many suggestions on how to combat specific contributing risks during the movement of vertically connected containers, such as tipovers, helicoptering, and disengagement or failure of the interbox connectors to engage. These risks point to the need to address the safety of employees working near VTL operations to protect these employees in the event of failure or overturn of vertically connected containers. The following is a summary of comments and testimony from rulemaking participants that support the Agency's decision to include the safe work zone parameters in the final rule:

1. Tipovers

Whenever containers are stacked, there is increased potential for tipovers—both of the containers themselves and the crane performing the lift (for more information on cranes, see the discussion of the issue entitled ''Crane type,'' earlier in this section of the preamble). Though the containers are required to be empty, there is still the risk that the containers themselves could be top-heavy (for example, if the tare weight of the top container is greater than that of the bottom), increasing the risk of tipover incidents. Ron Hewett of APM Terminals summed up the issue in a single succinct sentence: ''The shadow cast by a vertical tandem lift tipover would be greater than a single container tipover'' (Tr. 2–228).

2. Disengagements

As noted previously in this section of the preamble, there was sufficient testimony to indicate that the failure of interbox connectors to engage—which could cause the containers to separate and drop—was of paramount concern. Several union members testified to situations where this had occurred and industry representatives acknowledged that such incidents had occurred, though they had not resulted in injury (Exs. 11–1B, 11–1P; Tr. 1–104, 1–106). Some participants, such as Mr. Matthew Lepore of the ILA, expressed concern for those in the vicinity of a VTL when the interbox connectors fail. He stated that: ''When you get to the dock, you're talking about separation or you're talking about moving this double, or triple * * * [Y]ou're going to have more people who have nothing to do with it, but are working in the area'' (Tr. 1–344). He further explained:

> You have superintendents, you have checkers, you have [employees designated to other areas, who have wandered over or are passing through], you have tractor drivers, [and] you have the person that's going to separate it if you're not going to use the crane. All of these [people] come into play. [Tr. 1–344—1–345]

Mr. Ross Furoyama, ILWU, talked about the additional danger to workers within a certain distance of VTLs. He stated that as VTLs are being brought from one place to another, there is a certain radius to the swing of the unit as it moves through the air and ''if there's any kind of separation, those [employees] are in a danger zone'' (Tr. 1–311).

Mr. Jerry Ylonen, also with the ILWU, added the perspective of a crane operator. ''I have to drive from that crane, underneath five other cranes working in a safe way, and then exit the forward end of the ship, come back, and then go into the yard,'' he said. ''So that footprint is what really we need to look at, you should consider, because that is where the most danger is to people'' (Tr. 2–361). Mr. Lepore supported Mr. Ylonen's concern about cranes, but offered a solution that has worked at Maersk Sea-Land:

> Our dock is a lot safer place now than it was [before the Maersk takeover of Sea-Land].
>
> The reason is this: When you have vertical tandem lifts, especially in a company like ours where we get 14 to 17 ships a week, and at the time we were getting in the area of 12 to 15 with Sea-Land, you had more than one gang on a ship.
>
> So if the center gang is doing mostly discharge, * * * you're going over people's heads, even if they're in another gang. If * * * the double-pick breaks loose, it's going to swing over in the area that's away from underneath the legs of the crane.
>
> All of the operation was performed underneath the legs of the crane when Sea-Land did it that way. We never did anything away from it, other than when we loaded. [Tr. 1–319—1–320]

The solution presented by Mr. Lepore, performing ground operations under the crane legs, not only improves safety of the VTL, but ensures that the operation satisfies the requirement in existing § 1917.71(d)(2), which requires employees to stay clear of the area beneath suspended containers.

3. Vicinity

Most rulemaking participants agreed that the employees most at risk during VTL operations are those in the immediate vicinity of the movement of vertically connected containers. Sea-Land representative Phillip Murray stated that although some parties ''have suggested the establishment of a 100[-foot] stand clear zone for multipick operations[,] these parties provide no basis for this assertion.'' He felt that existing stand clear zones have been adequate (Ex. 19).

In a broader discussion, some participants testified that they just do not allow anyone under a container during a VTL (Tr. 2–62), or they do not consider the containers to be at a point of rest until they are separated (Tr. 2–39). However, most participants suggested rough estimates of a safety zone if a container became accidentally separated. ILWU member Jerry Ylonen described the steps taken at his terminal saying, ''what happens now, I would say everybody gets at least 15 feet away, stands back out of the way 15 to 20 feet [for a single container]'' (Tr. 2–359—2–360). Brian McWilliams, President of the ILWU, submitted an excerpt from Rule 1513 of the Pacific Coast Marine Safety Code to the record, which reads:

> Employees shall not walk or work in the aisle adjacent to a container bay being loaded or discharged, except when the uppermost tier is being worked. Employees lashing or unlashing when the uppermost tier is being worked shall maintain a minimum athwartship distance of five (5) container widths or half the width of the tier, whichever is greater, offshore of the container being handled by the crane. [Ex. 4]

Other policies suggested or implemented included ''stand clear'' areas (Ex 10–5, Ex 43–5), a minimum 30.5-meter (100-foot) stand clear zone (Ex 43–10–3, p. 13), having employees stand in front or in back of the cranes (Tr. 2–227), clearing a section of deck or the dock (Tr. 2–388, 2–415), safety bulletins (Tr. 2–228—2–229), and employees standing in front of the bomb cart or chassis and in back of the plane (Tr. 2–115).

An idea offered by both Robert Anderson, Ph.D., P.E., on behalf of ILWU, and Ron Hewett of APM

Terminals, was to use a worst-case analysis (Ex 54–30–1; Tr. 2–228). They suggested that the largest area potentially affected by a tipover or release of twistlocks be examined first, and then work to keep employees away from that area. However, Mr. Hewett did say that he believed it would be wise if OSHA explored setting standards for the location of people on the ground during VTLs (Tr. 2–229).

In regard to establishing safe work zones, there was some specific disagreement about how to treat truck drivers. Rulemaking participants disagreed about whether the risk to truck drivers is inside or outside of the cab. Mr. Freese argued that his drivers are going to walk away to a spot they feel safe (Tr. 2–381). Anthony Simkus, Virginia International Terminals, agreed, saying that a truck driver would be in trouble if there was a separation and containers fell onto a chassis. (Tr. 2–64) Yet, Bill Williams, Maersk, argued that the practice of bomb cart drivers staying in the cab during VTL loading is absolutely safe and safer than being outside of the cab (Tr. 2–174).

4. Conclusion

Taking into consideration the record as a whole, the Agency has decided to regulate safe work zones and footprints in its final rule, believing that ultimately safe work zones will protect employees from being injured if a VTL does fail or vertically connected containers tip over. The final rule supplements the existing prohibitions against employees working under an elevated container, with a requirement for employers to create a safe work zone that will protect employees in case a container drops or overturns. The transport plan must include the safe work zone and procedures to ensure that employees are clear of this zone when vertically connected containers are in motion. OSHA believes that this provision is important to protect the safety of employees working near VTLs.

Viewpoints varied as to optimum dimensions of a safe work zone, the majority of rulemaking participants addressing this issue did agree that the employees most at risk during VTL operations are those in the immediate vicinity of the vertically connected containers. Most of these participants provided rough estimates of a safe work zone if a container became separated. For instance, according to Jerry Ylonen, the ILWU recommends that employees stand at least 4.6 to 6.1 meters (15 to 20 feet) from a single container, a distance that equals at least twice the height of a container. Brian McWilliams of the ILWU reiterated the PCMSC rules that recommend a five-container width or half the width of the tier—whichever is greater—as an acceptable safe work zone.

Vertically connected containers being transported over the ground present a tipover hazard (Tr. 2–228). VTLs being moved by crane present a disengagement hazard (Exs. 11–1B, 11–1P; Tr. 1–104, 1–106). A safe work zone must protect employees against both of those hazards. In a tipover, the vertically coupled containers would fall over, landing a distance from the bottom corner of at least the height of the VTL. Additionally, the momentum of the falling containers would carry them some distance beyond that. In a worst-case disengagement, the bottom container would pivot about one end before falling to the ground.[29] If the falling container tipped over lengthwise on landing, it would strike the ground a distance equal to the length of the container from the area immediately below the VTL.

OSHA has decided not to set minimum dimensions of the safe work zone because conditions vary from terminal to terminal. Vertically connected containers being transported by ground transport equipment pose an overturn hazard. The distance the containers will fall in a tipover will depend, upon other things, on turn radius and vehicle speed. VTLs moved by a container gantry crane will have little rotational momentum, and this will affect where the containers land if the containers become uncoupled.

Although OSHA will allow employers to use discretion in setting safe work zones, employers will need to consider where containers will land in the event of tipover or VTL failure and set the zones accordingly. Furthermore, even though the standard does not require a designated place for employee to stand in each terminal, employers will have to ensure that employees know where a safe retreat is available before the crane or other equipment moves vertically connected containers.

G. Reporting of VTL Accidents

In its proposal, OSHA requested information on whether the final rule should include a requirement for reporting VTL accidents and near misses. Such a requirement would have provided the Agency with additional information on which to base any future rulemaking on VTL operations.

The ILWU and the ILA recommended that the final rule include a provision requiring the reporting of accidents and near misses (Exs. 43–10, 44–1). The ILWU stated:

> The ILWU strongly urges OSHA to include regulations establishing a reporting mechanism for all VTL accidents, near-misses and any incident related to VTLs, including defects in the components comprising the VTL, e.g., the interbox connector and/or container(s) (''VTL accidents and incidents'') in the event OSHA's final rule-making sanctions VTLs. * * * Because this practice has gone on for so long virtually unregulated and unmonitored, whereby maritime industry employers have been allowed to circumvent even the minimal and inadequate requirements set out in the Gurnham Letter, the agency should establish a VTL-monitoring division to allow workers as well as employers to supply information with respect to any and all VTL accidents and incidents causing and/or potentially threatening harm to marine terminal and longshore workers. [Ex. 43–10]

The ILWU further stated that these reports should be submitted to Federal and State authorities, including the U.S. Coast Guard, and to employee representatives (Ex. 43–10). They further recommended that VTL operations cease until the accident or incident was investigated.

The ILA also urged OSHA to require all VTL-related incidents to be reported to the Agency on an as-occurring basis, but no less than quarterly (Ex. 44–1). They argued that an incident is no less an indication of an underlying problem than an accident involving reportable injuries. The ILA additionally urged the Agency to defer the final VTL standard until it implemented an effective VTL incident reporting system and collected additional data to determine the safety of VTLs compared to lifts of single containers.

In a joint comment, USMX, NMSA, and PMA opposed a requirement for accident and incident reporting (Ex. 47–5), stating:

> There is no need for a special reporting mechanism for VTL accidents and near misses. With regard to near misses, how would these instances be defined? We had considerable difficulty with the term ''near miss'' after the promulgation of the final rules on Powered Industrial Truck Operator Training. Instituting such a procedure without any evidence that VTLs pose an enhanced risk to workers over single lifts, is inappropriate and in excess of the agency's authority. [Ex. 47–5]

However, under questioning at the public hearing several industry representatives acknowledged that

[29] Because the final rule requires both containers in a VTL to be empty, the combined weight of the two containers will be well within the rating of the crane and disengagement of the top container from the spreader bar is extremely unlikely—certainly less likely than in a lift of a single container loaded to its maximum weight. As noted earlier, this can be 30 metric tons or more.

companies have internal reporting mechanisms for accidents and near misses (Tr. 1–192, 1–229, 2–224).

OSHA does not agree with these commenters that a reporting requirement would be in excess of the Agency's authority. The Occupational Safety and Health Act of 1970 (OSH Act) explicitly gives the Agency authority to promulgate regulations that require reports ''[f]or developing information regarding the causes and prevention of occupational accidents and illnesses'' (29 U.S.C. 657(c)(1)). Requiring employers to report accidents and near misses would certainly fall within this authority.

While OSHA agrees with the ILWU and the ILA that fatality, injury, and accident reporting is useful, the Agency has decided not to include a reporting requirement in its final VTL standard. The comments by the ILWU and ILA appear to support reporting mechanisms for three purposes. First, longshore workers should be able to report safety problems to OSHA. Second, reports of VTL incidents could be used to schedule OSHA inspections to determine the cause of the incident, identify any corrective measures that would have prevented the incident, and issue citations for infractions of OSHA standards. Third, VTL incident reports could be compiled and analyzed to look for accident trends and causes. This information could then be used to determine the need for additional requirements in the OSHA standards.

The Agency has determined that mandatory VTL reports are not needed to make sure that longshore workers are able to report safety problems to OSHA, to schedule OSHA inspections, or to produce statistical information. The OSH Act explicitly gives employees the right to report unsafe conditions and request a workplace inspection (29 U.S.C. 657(f)(1)). OSHA's regulations and policies allow employees to contact the Agency regarding unsafe working conditions and ask for a worksite inspection (see, for example, 29 CFR 1903.11). A large proportion of OSHA's annual inspections are conducted as a result of such employee complaints.

OSHA already has regulations at 29 CFR Part 1904 requiring employers to report any work-related fatality and any work-related accident resulting in the hospitalization of three or more employees. OSHA also responds to employee complaints, media reports of unsafe working conditions, and referrals from other parties who inform the Agency of safety and health problems. These regulations and policies are expected to give the Agency ample opportunity to investigate any serious VTL incidents that may occur without the need for additional reporting or other paperwork burdens.

OSHA does not agree with the ILA that it should delay the rulemaking until the Agency implements an incident-reporting system, collects data (presumably for several years), and produces reports on that information. OSHA has been monitoring marine terminals for VTL incidents for more than 20 years. Given the small number of incidents that have occurred during that time, this type of data collection is not likely to produce enough data to be worthwhile. In addition, a reporting system that would truly compare single-container lifts and VTLs would require the reporting of all single-lift and VTL incidents, and how many of each lifts is performed—a more burdensome requirement than simply requiring the reporting of VTL incidents. Finally, requiring a reporting system before adopting a VTL standard would result in unreasonable delay of the final standard. Unnecessarily delaying the safety provisions of this final rule could result in preventable longshore accidents, injuries, and fatalities.

H. Summary and Explanation of Regulatory Text

OSHA is issuing new provisions in the Longshoring and Marine Terminals Standards (29 CFR Parts 1918 and 1917) to regulate the use of VTLs. These new provisions are based on objective research, industry experience with VTLs, ISO standards, the ICHCA VTL guidelines, and the rulemaking record on VTLs contained in Docket S–025a. The provisions provide safe work procedures (engineering, work-practice, and administrative controls) for lifting two empty containers connected by interbox connectors. Testing has demonstrated that the interbox connectors required by the new provisions are substantially strong enough to lift two empty containers with a safety factor of at least five.

The new requirements for VTLs are contained in the Marine Terminals Standard (29 CFR 1917). The Longshoring Standard (29 CFR 1918) incorporates those requirements by reference. OSHA is requiring that VTLs only be performed by a shore-based container gantry crane or another type of crane that has the precision control necessary to restrain unintended rotation about any axis, that is capable of handling the load volume and wind sail potential of VTLs, and that is specifically designed to handle containers. In accordance with 29 CFR 1917.1(a), which states that cargo handling done by a shore-based crane is covered by Part 1917, the requirements that address the makeup of a VTL, such as the number of containers, are in Part 1917. Requirements that address the certification and testing of interbox connectors are in both Parts 1917 and 1918. Interbox connectors are vessel's gear, that is, gear owned and maintained by the vessel, and they would be addressed in Part 1918. However, interbox connectors can also be used in the marine terminal to assemble VTLs before they are loaded on the vessel; therefore, the same certification and testing requirements for interbox connectors that are contained in Part 1918 are also contained in Part 1917. The VTL requirements for Part 1917 are discussed first.

1. Definitions

OSHA had proposed to add definitions of the terms ''liftlocks'' and ''vertical tandem lift'' to § 1917.2 in the Marine Terminals standard and to § 1918.2 in the Longshoring standard. The final rule uses the term ''interbox connector,'' a term used in the proposed definition of ''liftlock,'' in place of the word ''liftlock.'' Consequently, the Agency is not including the proposed definition of ''liftlock'' in the final rule.

The final rule incorporates the definition of ''vertical tandem lift'' into the scope of the VTL provisions. Therefore, a definition of that term is unnecessary, and the final rule does not include the proposed definition of that term either.

2. Incorporation by Reference

OSHA had proposed to incorporate by reference into the Marine Terminal and Longshoring standards ISO Standard 3874, Amendment 2, Vertical tandem lifting (2002). This ISO standard limits forces during VTLs to 75 kN and requires the load-bearing surface area of interbox connectors used in VTL operations to be a minimum of 800 mm^2 (Ex. 40–9). The Agency has incorporated the necessary strength requirements into the text of the final rule. In addition, the final rule limits VTLs to two empty containers, making a weight limitation unnecessary. Thus, OSHA has not included the proposed incorporation by reference of the ISO standard in the final standard.

In addition, in § 1917.71(f)(3)(i), OSHA proposed to require containers lifted in VTLs to be ISO series 1 containers. The final rule does not contain an explicit requirement that VTLs be conducted only with ISO series 1 containers. OSHA believes that, with the standardization of intermodal containers, the only practical way to lift containers in a VTL is with standard containers having top and bottom corner castings that interconnect with standardized interbox connectors. The final rule does contain requirements for the certification of these connectors. The Agency believes that it would be impractical, if not completely unworkable to use anything other than a standard ISO series 1 containers in a VTL operation. For example, the operation would encounter problems with the interbox connectors engaging in nonstandardized corner castings. In addition, the final rule explicitly prohibits lifting platform containers in VTLs. The Agency would consider the lifting of vertically coupled other types of non-ISO series 1 containers as being outside the scope of the final rule and subject to the general duty clause of the OSH Act.

3. Load Indicating Devices

OSHA had proposed, in the Marine Terminal standard, to require container gantry cranes used in VTL operations to have load indicating devices. The load indicting device was intended to ensure that the weight of a VTL did not exceed 20 tons as required by the proposal. As explained earlier in this section of the preamble, the Agency has decided to permit VTLs of empty containers only. The existing Marine Terminal standard requires the employer to know whether a container is empty or loaded before it is hoisted (29 CFR 1917.71(b)(1) and (b)(2)(ii)). In addition, as explained later in this section of the preamble, the final rule requires employers to verify that each container in a VTL is empty before it is lifted. OSHA has concluded that these provisions will ensure that only empty containers will be lifted in VTLs, making a requirement for load indicating devices unnecessary. Therefore, the final rule does not carry forward this proposed requirement.

4. Stowage Plan

OSHA proposed a requirement in the Marine Terminals Standard that a copy of the vessel cargo stowage plan be given to the crane operator and that the vessel cargo stowage plan be used to identify the location and characteristics of any VTLs to be lifted (proposed § 1917.71(b)(9)). This provision was intended to supplement existing § 1917.71(b)(1) and (b)(2)(ii), which require the gross weight of containers to be marked or a stowage plan to be available.

The final rule permits only empty containers to be lifted in a VTL. In addition, as explained later in this section of the preamble, the final rule requires employers to verify that each container in a VTL is empty before it is lifted. OSHA has concluded that these provisions will ensure that only empty containers will be lifted in VTLs, making requirements for the stowage plan to be provided to the crane operator and for the plan to be used to identify containers lifted in VTLs unnecessary. Therefore, the final rule does not include these proposed requirements.

5. VTLs

New paragraph (i) of § 1917.71 in the final rule adds requirements for VTL operations to the Marine Terminals Standard. These new requirements apply to operations involving the lifting of two or more intermodal containers by the top container, or VTLs.

Final § 1917.71(i)(1) requires each employee involved in VTL operations to be trained and competent in the safety-related work practices, safety procedures, and other requirements in this section that pertain to their respective job assignments. The rationale behind this requirement is explained earlier in this section of the preamble under the issue entitled ''Training.'' This provision in the final rule ensures that employees who are involved in VTL operations have the training needed to perform their tasks safely (safety-related work practices), perform their VTL-associated tasks so as to comply with the standard (safety procedures), and competently perform the inspections and determinations required by the final rule.

OSHA proposed to permit a maximum of two containers to be lifted in a VTL (proposed § 1917.71(f)(3)(i)). As explained earlier in this section of the preamble, the Agency has determined that a maximum of two containers may be safely lifted in a VTL. Therefore, OSHA has included this requirement in the final rule as § 1910.71(i)(2).

OSHA proposed to permit a maximum of 20 tons to be lifted in a VTL (proposed § 1917.71(f)(3)(i)). As explained earlier in this section of the preamble, the Agency has concluded that only empty containers may be lifted in VTLs. This will ensure that the capabilities of the corner castings and interbox connectors attaching the two containers are not exceeded.

In addition, the Agency believes that it is essential to ensure that containers lifted in a VTL are empty. The existing Marine Terminals standard requires that the employer know whether a container is empty or loaded before it is hoisted (§ 1917.71(b)(1) and (b)(2)(ii)). For containers being discharged from a vessel, most employers and employees rely on the vessel cargo stowage plan, also called a stow plan, that shows: The location of each container on the vessel, the container's unique identification number, the weight of the container, and other information, such as if the container contains hazardous material. For containers being loaded onto the vessel, the same information is contained on a stowage plan that shows where the containers are to be placed on the vessel. This method of determining the weight of a container is adequate for handling containers individually. This is because if the stowage plan understates the weight of the container, the hoisting of a fully loaded container will not overload the crane. However, it is not adequate for handling a VTL, because if the weights of multiple containers are understated, the hoisting of those containers in a VTL could overload the interbox connectors and corner castings joining the containers.

Evidence in the record indicates that containers that were supposed to be empty were, in fact, loaded. For example, at the 1998 meeting on VTLs, a crane operator testified:

> I know I've picked up containers they told me were empty and I say it's a load. And they say, no, it's an empty. I tell them, listen, this is a load. And they don't know it until they get it down. [1998–Tr. 252].

Another participant at the public meeting observed:

> What concerns Peck and Hale as an American based company that supplies equipment to ships worldwide is that of safety. OSHA can approve empty lifting but no one can guarantee that these containers are empty. Containers are shifted in ports. Containers are mismarked and not accurate[ly] weighed. [1998–Tr. 161]

This evidence was not disputed in the rulemaking record on the proposal. In fact, at the public hearing on the proposal, Mr. Tyrone Tahara testified that some containers in VTLs that were supposed to be with empty containers seemed to have load in them (Tr. 2–421). Therefore, the Agency has concluded that it is essential for the employer to ensure that containers are empty before they are lifted in a VTL, as required by final § 1917.71(i)(3). Although the rule does not prescribe a particular method for ensuring that a container is empty, OSHA intends that employers make a positive determination, such as through direct observation of the content of the container or by weighing it to make sure that its weight matches the tare weight marked on the container. For example, an employer could use a container crane's load-indicating device [30] to

[30] It should be noted that only load-indicating devices meeting § 1917.46(a)(1)(i)(A) are acceptable.

measure the weight of the container individually as the containers are positioned in a VTL or during the prelift. Although the stowage plan can be used to help locate potentially empty containers, employers may not rely solely on that plan in complying with new § 1917.71(i)(3).

Paragraph (i)(4) of § 1917.71 in the final rule addresses the type of crane that can be used to perform VTLs. The final rule requires VTLs to be performed only by shore-based container gantry cranes and other types of cranes that (1) have the precision control necessary to restrain unintended rotation of the containers about any axis, (2) are capable of handling the load volume and wind sail potential of VTLs, and (3) are specifically designed to handle containers. The rationale for this requirement is addressed previously in this section of the preamble under the issue entitled, ''Crane Type.''

Paragraph (i)(5) of § 1917.71 in the final rule requires that the crane operator conduct a prelift before hoisting a VTL. A prelift is a pause in the VTL as the initial strain is taken and the lifting frame wires are tensioned. This physically tests the interbox connectors to ensure that they are engaged. This is consistent with the practice used by Sea-Land, as previously described. Testifying on behalf of Sea-Land at the 1998 public meeting, Mr. Philip Murray stated that prelifts are a necessary safety precaution for VTLs, arguing that they helped detect interbox connectors that were not fully engaged (1998–Tr. 202). At the public hearing, Michael Bohlman also recommended that prelifts be conducted (Tr. 1–209). In addition, the ICHCA guidelines, in section 8.2.2.1.7, require prelifts.

The ILWU argued that prelifts did not necessarily ensure the safety of a VTL (Exs. 43–10, 47–4, 50–7), reasoning as follows:

> Contrary to OSHA's belief, requiring a crane operator to conduct a pre-lift before hoisting a VTL * * * will not necessarily ensure that the interbox connectors are properly engaged. The proposed rule does not specify how long the lift should take place. Nor does it establish that the locks and/or the containers' bottom corner castings can withstand the duration of the lift, even if the connectors are initially engaged. As explained above, severely stressed and/or internally cracked SATLs and cones and corner castings are not always viewable upon cursory inspection. In addition, a pre-lift does not ensure that the VTLs can withstand the sudden un-weighting effect that occurs when a crane's trolley goes over a rail splice or cracks in the rail. Moreover, if a VTL is at or near its 20-ton maximum weight limit, when the trolley hits a rail splice, the weight of the containers increases significantly on the rapid and jerking descent immediately following the splice. [Ex. 43–10]

Although OSHA agrees that prelifts cannot, by themselves, ensure the safety of VTLs, the Agency has concluded that VTLs can indeed be performed safely under certain circumstances and that prelifts are an essential component of ensuring employee safety. Prelifts will expose conditions involving two disengaged interbox connectors on one side. Limiting VTLs to empty containers ensures that the lift will be safe even if only two interbox connectors are fully engaged on opposite sides (that is, along the diagonal), a condition that the prelift may not detect. Inspecting interbox connectors and corner castings immediately before the lift ensures that the connectors are in proper working order, thus, making partial engagement less likely. Therefore, by requiring prelifts along with other necessary precautions, OSHA believes that the rule will adequately protect employees.

Proposed § 1917.71(f)(3)(iii) would have prohibited VTLs of containers with hazardous cargo, liquid or solid bulk cargoes, or flexible tanks that were full or partially full. The final rule requires containers lifted in VTLs to be empty. Thus, this proposed requirement is unnecessary.

Paragraph (i)(6) of § 1917.71 in the final rule prohibits VTLs of any containers that are in the hold of a vessel. Containers are stacked in the hold in cell guides (steel beams constructed to secure stacks of containers). There is not enough clearance for the handle of an SATL to fit between the interbox connector and the cell guide—the handles would break off in the cell guide as containers were lowered into the guide. In such cases, it would be impossible to inspect the interbox connectors immediately before the lift or to determine the condition of the containers. No substantial objections were received to this requirement, which was proposed as § 1917.71(f)(3)(v).

Paragraph (i)(7) of § 1917.71 of the final rule prohibits the handling of VTLs when the wind speed exceeds 55 km/h or the crane manufacturer's recommendations, whichever is lower. This limits both the loads imposed on the interbox connector-to-corner casting connection and the ability of the crane operator to safely handle a VTL and keep it under control. This provision is similar to proposed § 1917.71(f)(3)(vi), which would have set a maximum wind speed of 55 km/h without regard to the crane manufacturer's recommendation.

Several rulemaking participants were concerned that the proposed maximum wind speed for VTL operations was too high (Exs. 43–4, 43–10, 44–1, 47–3, 51–4, 54–28). Noting the role that wind conditions play in VTLs, the ILA argued that the proposed 55-km/h limit was excessive (Ex. 44–1). Stating that common sense demands a lower maximum wind speed for VTLs than for single lifts, the ILWU urged OSHA to conduct studies to establish a safe wind speed (Ex. 43–10). Some rulemaking participants maintained that factors such as the VTL configuration, weight, forecasts, and equipment should be considered in setting a maximum wind speed (Exs. 43–5, 44–1, 51–4, 54–28). For example, David Reda, an ILWU member, stated:

> Performing [VTLs] at a maximum weight of 20 tons and/or empties. You have twice the surface area which when wind speed is added can push the tandem load in an uncontrollable twisting manner. This is hard on the crane and the wire can be dislodged from the hoisting pulleys. [Ex. 43–5]

Michael Bohlman countered that the proposed 55-km/h limit was too low for two-tier VTLs (Ex. 50–10–2):

> Under both the OSHA proposed rule and the Safety Panel's guidelines, VTL operations should cease if the wind speed exceeds 34 mph. The Safety Panel's recommendation however, was based on a three-tiered VTL configuration. Two tier VTL units can be operated safely in much higher winds, winds that are 25 to 40% higher than those established for safe 3-tier operation. [Ex. 50–10–2]

He urged OSHA to permit higher wind speeds if the final rule prohibited three-tier VTLs. Other rulemaking participants generally supported the proposed 55-km/h wind speed limit (Exs. 50–10–3–1, 50–12). Their support was based on the ICHCA guidelines.

OSHA recognizes that the ICHCA guidelines (Ex. 41) limit the maximum wind speed to 55 km/h based on loading considerations involved in a three-tier VTL. However, as noted previously, other factors besides maximum safe load come into play in the determination of a maximum safe wind speed. For example, a higher wind speed can cause the load to rotate more (Tr. 2–296–297). Michael Arrow stated that a maximum wind speed of 55 km/h is based both on engineering analysis and practical experience (Ex. 50–10–3–1). In addition, the Agency has used 48 to 64 km/h as a guideline for when to consider wind speeds as being hazardous for work that may involve material handling or

The alternative devices permitted by § 1917.46(a)(1)(i)(B) and (a)(1)(i)(C) do not provide a direct indication of the weight of the load. Thus, employers cannot rely on these alternative devices to ensure that each container lifted in a VTL is empty.

working at heights. (See, for example, 55 FR 13360, 13379 (April 10, 1990), the Walking and Working Surfaces proposed rule, and 59 FR 4320, 4373 (January 31, 1994), the Electric Power Generation, Transmission, and Distribution final rule.) Therefore, OSHA has concluded that the 55-km/h limit on wind speed for VTL operations is reasonably necessary and appropriate.

Some commenters raised concerns about wind velocity warning systems and manufacturers' recommendations regarding maximum wind speed (Exs. 43–10, 44–1, 47–4, 57). The ILA claimed that wind detectors have been problematic, but offered no evidence to support their assertion (Ex. 44–1). The ILWU noted that the proposed rule provided no guidance on warning systems and recommended that the final rule require them (Exs. 43–10, 47–4). They were also concerned that manufacturers' recommendations would override the standard's maximum wind speed as follows:

> The proposed rule provides no guidance on wind warning devices—apparatuses which sound an alarm to workers when the maximum wind velocity has been reached during container operations. The current practice for single-hoist (standard) container operations is to set each crane's wind warning according to the manufacturer's recommendation. The ILWU strongly urges that should OSHA establish a standard for maximum wind speed for VTL operations, this standard should be required for all VTLs operations irrespective of the crane manufacturers' recommendation. [Ex. 47–4]

Existing § 1917.45(g)(3) requires cranes located outdoors to have wind-indicating devices to provide warnings when the wind velocity approaches the crane manufacturer's recommended maximum. The Virginia International Terminals crane operations manual states that the warning system installed on their cranes provides a warning at 55 km/h and that crane operations begin shutting down at that speed (Ex. 57). It is possible that some crane manufacturers set lower maximum wind velocities than those for the Virginia International Terminal cranes. Because of this, the final rule, in § 1917.71(i)(7) requires the maximum wind speed for VTL operations to be the lesser of (1) 55 km/h or (2) the crane manufacturer's recommendations. This will ensure that cranes are operated within their safe operating conditions and will limit wind velocities to a recognized safe level for VTL operations. The language in the final rule also clarifies that the absolute maximum wind speed for VTL operations is 55 km/h even if the crane manufacturer sets a higher maximum recommended wind speed.

Paragraph (i)(8) of § 1917.71 in the final rule sets requirements for interbox connectors used in VTL operations. Paragraph (i)(8)(i) requires interbox connectors to lock automatically and unlock manually. This provision specifically prohibits the use of manual twistlocks and latchlocks. This provision has been taken from the definition of ''liftlock'' in the proposal and from proposed § 1917.71(m).

Manual twistlocks, which have largely been replaced by SATLs due to OSHA's container top safety regulations and increased productivity (see discussions in the Longshoring and Marine Terminals Final Rule, 62 FR 40174), do not have a positive locking mechanism. By contrast, SATLs have a locking device that uses spring tension to prevent it from unlocking. Manual locks could unlock through normal container handling, making them unsuitable for lifting. The limits and weaknesses of latchlocks for VTLs were more fully discussed earlier in this section of the preamble. The ILA supported the proposal's prohibition against the use of manual twistlocks (Exs. 44–1, 55–1). The ICHCA guidelines, in section 8.1.1.11, also prohibit manual twistlocks from being used in VTL operations (Ex. 41).

Paragraph (i)(8)(ii) of § 1917.71 in the final rule requires interbox connectors used in VTL operations to indicate whether they are locked or unlocked. Paragraph (i)(8)(iii) of § 1917.71 in the final rule requires all interbox connectors in a VTL to lock and unlock in the same manner. Some SATLs lock and unlock in a horizontal direction, others in a vertical direction. What is important and required is that all the twistlocks in a VTL work in the same manner to allow employees involved in VTLs to determine readily whether or not the locks are locked or unlocked before a lift is performed. For an observer to determine whether the interbox connectors are locked or unlocked, they must have a telltale, which is typically a solid metal lever or a flexible wire, possibly painted to enhance visibility. This allows employees working with VTLs to see whether an interbox connector is locked or unlocked.

These two paragraphs in the final rule are based on proposed § 1917.41(l)(1)(vii). This provision in the proposal also required all interbox connectors on a vessel to operate in the same direction and required the telltale on twistlocks to be visible from deck level. OSHA has not included these requirements in the final rule. As explained earlier in this section of the preamble, OSHA has decided to require a visual inspection of each interbox connector and corner casting involved in a VTL immediately before the lift. In addition, in § 1917.71(i)(5), the final rule requires a prelift. The inspection and the prelift will help ensure that interbox connectors will be properly engaged. The inspections will normally be conducted close to the containers being lifted, so there is no need for employees to be able to determine if the twistlocks are engaged when the containers are stacked on a vessel. Thus, the requirements for the telltale to be visible from deck level and for all twistlocks on a vessel to operate the same way are unnecessary.

Paragraph (i)(8)(iv) of final § 1917.71 requires interbox connectors used in VTLs to be certificated as loose gear under § 1917.50. The marine terminal standards, in § 1917.50, require certain equipment to be certificated by a competent authority. Currently, loose gear (which under the final rule would include interbox connectors used in VTLs) in the U.S. is certificated by OSHA-accredited agencies under 29 CFR part 1919, Gear Certification. Foreign flag vessels carry certificates issued by the recognized body appropriate for that country. Often the recognized body issuing certifications is a classification society such as the American Bureau of Shipping, Lloyds Register, or Bureau Veritas.

OSHA and the U.S. Coast Guard are the competent authorities for certifications in the United States. Other countries would have their own competent authority that would have jurisdiction over VTL operations in that country. Certification of interbox connectors used in VTLs, which is verified by certificates issued by agencies authorized by a competent authority, is the primary way an employer will determine that SATLs on a vessel or ashore can be used for lifting. These certificates are found in the vessel's cargo gear register.

Some rulemaking participants supported the proposed requirements for certificating interbox connectors used in VTLs (Exs. 43–10, 44–1, 47–3). For example, the ILWU argued that major shipping companies do not operate entirely with their own equipment and that there are random combinations of containers and connectors (Ex. 43–10). They urged OSHA to require certification of containers as well as interbox connectors.

Some comments opposed the proposed requirement for SATLs used in VTLs to be certificated (Ex. 47–5). For example, USMX stated:

The regulation the agency proposes requires certain markings on SATLs and certain testing protocols that have absolutely nothing to do with the strength or quality of the SATL. It is undisputed (and substantiated by the NIST Report) that every single SATL in use today was fabricated to conform to international standards that would permit complete confidence in conducting VTL configurations as outlined by ISO 3874. Thus * * * it should be clear that the regulations concerning the certification of SATLs as liftlocks are not necessary and present a significant impediment to the utilization of VTLs. [Ex. 47–5]

As explained in detail earlier in this section of the preamble, OSHA has concluded that the NIST tests are not representative of all SATLs currently in use. In addition, contrary to USMX's position, the NIST testing indicates that some SATLs do not meet ISO requirements on load-bearing area (Ex. 40–10). In addition, the ICHCA guidelines, in sections 8.1.3.1.2 and 8.1.3.2.1, require twistlocks used in VTL operations to be certificated (Ex. 41). Consequently, OSHA has concluded that certification is necessary to ensure that interbox connector-corner casting assemblies used in VTLs have adequate strength to ensure the safety of the lift. This conclusion is also consistent with the Agency's position that interbox connectors used in VTLs are loose gear and must therefore meet the current marine terminal standards requirements on loose gear, which requires certification under § 1917.50(c)(6).

On the other hand, OSHA has concluded that containers are not loose gear and thus do not need to be certificated. Containers are widely lifted in single units without being certificated. The ISO standards for containers and corner castings ensure that they are capable of safely supporting at least two empty vertically coupled containers. In addition, the prelift inspection required by § 1917.71(i)(9)(iii) will help ensure that the container is in good condition and that neither the container nor the corner casting will fail during the lift.

Paragraphs (i)(8)(iv)(A) and (i)(8)(iv)(B) of § 1917.71 in the final rule require interbox connectors used in VTLs to be certified as having a minimum load-bearing surface area of 800 mm^2 and as having a safe working load of 98 kN (10,000 kg) with a safety factor of five when the load is applied by means of two corner castings with openings that are 65.0 mm wide or equivalent devices. As explained in detail earlier in this section of the preamble, these requirements will ensure that interbox connectors are strong enough to withstand the loads imposed by VTL operations.

Paragraph (i)(8)(v) of § 1917.71 requires each interbox connector used in a VTL to have a certificate that is available for inspection and that attests that the connector meets the required strength criteria listed in paragraph (i)(8)(iv).

The ICHCA guidelines, in sections 8.1.3.1.2 and 8.1.3.2.1, require twistlocks used in VTL operations to be certificated with a safe working load of at least 10,000 kg on the basis of a safety factor of at least five (Ex. 41). ISO 3874 requires interbox connectors used in VTL operations to have a minimum load-bearing surface area of 800 mm2.

Paragraph (i)(8)(vi) of § 1917.71 requires that each interbox connector used in a VTL to be clearly and durably marked with its safe working load for lifting, together with a number or mark that identifies it and connects it with its test certificate.

This paragraph was taken from proposed § 1917.71(l)(1)(vi). The marking requirement was opposed by the International Chamber of Shipping, which argued that such marking presented an insurmountable challenge considering the vast numbers of SATLs in use (Ex. 47–1).

The ICHCA guidelines has required the same markings as the final rule since January 1, 2003 (Ex. 41). Thus, a substantial number of existing SATLs intended for use in VTLs already have these markings in place. In addition, employers, employees, and OSHA would have no way of distinguishing between complying SATLs and those that are not certificated without such markings. (The need for certification was discussed previously in this section of the preamble.) Thus, OSHA has carried the proposed requirement into the final rule without substantial revision.

Paragraphs (l)(1)(iii) and (l)(1)(iv) of proposed § 1917.71 addressed inspection of interbox connectors used in VTLs. Paragraph (k) of proposed § 1917.71 would have required damaged or defective connectors to be removed from service and prohibited their use for lifting. This paragraph would also have required a means of keeping damaged or defective interbox connectors separate from operating interbox connectors. These provisions in the proposed rule were intended to weed out damaged and defective interbox connectors in a systematic way.

The proposed rule would have required a thorough inspection by a competent person at least once every 12 months. This proposed provision garnered significant attention by rulemaking participants. Some commenters objected to the proposed requirement for annual thorough examination by a competent person (Exs. 43–7, 47–1, 47–5, 50–10–2, 50–10–3, 50–12, 54–3). They recommended that OSHA allow adherence to an approved continuous examination program (ACEP), as outlined in the ICHCA guidelines, in lieu of annual inspections. Michael Bohlman described ACEP as follows: ''Examinations under an [ACEP] are required to be carried out in connection with major repair, refurbishment, or on-hire/off-hire interchange at intervals of not more than 30 months'' (Ex. 50–10–2).

Section 8.1.3.3 of the ICHCA guidelines (Ex. 41) addresses the maintenance and examination of interbox connectors used in VTLs. Section 8.1.3.3.3 requires each such interbox connector to be inspected by a competent person at least once every 12 months, in language mirroring the first sentence of proposed § 1917.71(l)(1)(iii). However, the ICHCA guidelines also specifically recognize ACEPs in section 8.1.3.3.4 as one way of meeting the requirement for annual inspection.

Michael Arrow, representing USMX, argued that these programs make marking interbox connectors with the inspection date unnecessary (Ex. 50–10–3). Some of the commenters supporting ACEPs maintained that such programs ensured that interbox connectors were examined more frequently that once a year (Exs. 43–7, 54–3). Michael Bohlman, speaking on behalf of USMX, stated that ACEPs encourage a continuous heightened level of scrutiny (Ex. 50–10–2). However, responding to questions at the public hearing, Mr. Bohlman admitted that this type of program does not ensure the inspection of all interbox connectors:

We do about 10 percent a * * * voyage. There's probably statistics that someone could dig out of a book someplace that tells you over the course of a year you'll guarantee you're going to get 95 percent of the locks and over two years, 99.9 percent. [1998 Tr. 211–212]

Other rulemaking participants recommended that the standard not permit continuous examination programs (Exs. 43–10, 43–10–3, 43–10–7, 50–7, 54–30–2, 62, 64). Christine Hwang, commenting for the ILWU, argued that under an ACEP interbox connectors would be inspected less frequently than once per year (Ex. 43–10). Others argued that there was no adequate way of tracing inspections performed on individual connectors (Exs. 43–10–3, 64). For example, Douglas Getchell, speaking on behalf of the ILWU, stated:

Given the fact that twistlocks have no individual identification numbers and also that batch numbers (which would be of limited usefulness) soon become unreadable due to wear and tear, it would be interesting to discover exactly how Sea-Land is able to know that they have inspected 99.9% of their twistlocks. [Ex. 43–10–3]

The ILWU also maintained that ACEP is not appropriate for containers (where it has been used for many years) and would be even more problematic for interbox connectors used in VTLs (Ex. 64). They further argued that the ICHCA guidelines are problematic because they rely on the acceptance of inspection procedures performed by entities outside OSHA's jurisdiction (Ex. 54–30–2).

OSHA has concluded that an ACEP does not ensure that interbox connectors will be inspected more often than once every 12 months. In fact, based on Michael Bohlman's testimony, it is clear that Sea-Land's ACEP would capture only 95 percent of these devices in a 12-month period (1998–Tr. 211–212). In addition, Mr. Bohlman's testimony indicates that, in an ACEP, longshore workers would be the ones who do the inspections as the interbox connectors are being used, and that such inspections would not involve disassembly (Tr. 1–174—1–175). As explained later in this section of the preamble, the final rule requires inspections of the sort described by Mr. Bohlman immediately before each VTL. Therefore, the final rule does not recognize ACEPs as a means of compliance with the final rule's inspection requirements.

Several labor representatives stated that the proposed annual inspection is insufficient to ensure that interbox connectors are not damaged or defective during use in VTLs (Exs. 43–10, 44–1, 43–10–6, 51–4). For example, Herzl Eisenstadt, representing the ILA, stated:

The relative risk of VTL lifts of more than two containers must be correlated with the quality and dependability of the lift-locks (''shoes'') that are to be used in such moves. OSHA is abundantly aware that twistlocks * * * are connecting, rather than lifting, devices. The pressures and forces upon lift-locks are no different from those on [SATLs] during cross-ocean voyages. They can and do create damages and weaknesses that are parlayed during subsequent trips. The sooner that they are caught, the less likely that they will set the stage for a serious accident. It is therefore all the more imperative that properly noted and coded lift-locks be inspected more often than annually and that the periods for their inspection and, if need be, servicing, be readily ascertainable from markings on the body of the device. [Ex. 44–1]

Some commenters recommended that OSHA require inspection of these devices immediately before use in a VTL (Exs. 43–10, 50–7, 64). Christine Hwang, representing the ILWU, also recommended that interbox connectors be cleaned, as follows:

If OSHA ultimately permits SATLs or cones to be used for purposes of hoisting containers, these locks should not only be examined visually... but also tested for their structural integrity and proper functioning prior to and after each and every use. In addition to a pre-shift inspection of connectors and their corresponding manufacturers' certification, the locks should be thoroughly cleaned after each and every discharge. [Ex. 43–10]

Interbox connectors and containers are subject to considerable forces and abuse during shipping and handling (Exs. 43–8, 43–10–3, 50–7). According to industry expert Michael Arrow, a voyage across the sea exposes connectors and containers to greater forces than during VTLs (Tr. 1–45, 1–150—1–151). In addition, SATLs and corner castings are exposed to sea water, dirt, grime, snow, ice, and debris, which can interfere with the operation of the interbox connectors and can prevent them from fully engaging with corner castings (Exs. 43–10, 43–10–6, 47–6, 54–28). The interbox connectors are frequently dropped (Ex. 50–7), and containers land hard onto container truck chassis (Tr. 2–122—123). Although Mr. Arrow insisted that SATLs have proven to be resistant to dropping and shocks (Ex. 54–1), OSHA has concluded that the abuse and severe stresses these devices get during shipping and handling could damage them. OSHA has calculated the forces involved in lifting two empty containers to be near the safe working load for interbox connectors and corner castings. If the forces at sea are greater as the industry witnesses claim, then it is quite likely that these devices are commonly overloaded during transport. In addition, evidence that interbox connectors and corner castings are subject to debris and other contamination was uncontroverted. Thus, OSHA has determined that interbox connectors and containers, including, in particular, their corner castings, must be inspected immediately before being used in a VTL.[31] Accordingly, the final rule, in § 1917.71(i)(9), requires such an inspection. The requirement to inspect each interbox connector to determine that it is fully functional will uncover any dirt or debris that may hinder operation and eliminates the need for an explicit requirement to clean these devices.

For the purpose of paragraph (i)(9), ''immediately before use in the VTL'' means that the devices are inspected before the VTL takes place but after any event that could reasonably be suspected of damaging them. This means that the corner castings and interbox connectors could be inspected before the VTL is assembled, and the VTL stored in the terminal until it is ready to be loaded onto the ship. However, if an event occurs that could have damaged a corner casting or interbox connector (for example, a hustler colliding with an assembled VTL), the affected corner castings and interbox connectors would need to be reinspected. Additionally, the interbox connectors and corner castings in vertically coupled containers that have been shipped overseas would need to be inspected after shipment before the containers could be used in a VTL.

The proposal did not address inspection of containers or corner castings. Two rulemaking participants argued that the existing ACEPs for containers worked to ensure the quality of containers (Exs. 50–10–3, 50–12). For example, Michael Arrow, representing USMX, stated that ''the goal of [ACEPs] is quality assurance of components on a sound basis'' (Ex. 50–10–3). He noted that the ''ACEP option has been in place over twenty years with safety combined with widespread acceptance in the maritime industry'' (Ex. 50–10–3).

Other rulemaking participants disagreed that ACEPs were adequate and recommended that the final rule address the inspection of containers and corner castings (Exs. 43–10, 43–10–2, 43–10–7, 44–1, 47–4, 50–7, 54–30–2, 62). For example, Christine Hwang, representing the ILWU, was concerned about the lack of inspection or testing requirements for containers, stating:

The testing and certification gap is not only devoid of common sense, but also completely ignores the operational realities of container operations on the waterfront. The bottoms of containers and comer castings, which are critical to VTLs, are the most vulnerable to structural damage and weakening due to extremely rough handling and environmental conditions. [Ex. 43–10]

There was testimony that, due to the way that container inspections were performed under at least one ACEP, it was not possible to view the bottom castings completely (Tr. 2–389—2–390). Several commenters noted that, although the Coast Guard spot checks containers for safety, these inspections cannot ensure the integrity of every container used in VTLs (Exs. 43–10–2,

[31] As noted in section VI, ''Final Economic Analysis and Regulatory Flexibility Analysis,'' later in this preamble, OSHA realizes that requiring an inspection immediately before the VTL may make ship-to-shore VTLs impractical.

47–4). Other rulemaking participants argued that ACEPs are not adequate to ensure the safety of containers and corner castings (Exs. 43–10, 43–10–7, 62). For example, Christine Hwang, representing the ILWU, noted that, under the ACEP, containers are only inspected 5 years after their manufacture and every 30 months after that (Ex. 43–10).

There is evidence in the rulemaking record that containers and their corner castings may be damaged during use or clogged with debris (Exs. 43–10, 43–10–4, 43–10–6, 54–28). For example, the ILWU submitted photographs of damaged containers (Ex. 43–10–4). These containers would be unsuitable for use in VTLs. Other commenters noted that debris, ice, and snow could prevent interbox connectors from fully deploying, resulting in a load-bearing surface area that was too small and therefore potentially unsafe (Exs. 43–10, 43–10–6, 54–28). OSHA shares the concerns of these rulemaking participants that containers and corner castings could be used in VTLs when they are either damaged or when the corner castings do not provide a suitable load-bearing surface area. On the basis of the evidence that containers and corner castings with such defects are currently in use, the Agency has concluded that existing ACEPs are insufficient to ensure that containers and corner castings are in a condition making them suitable for VTLs. Thus, in the final rule, OSHA is requiring that containers and corner castings be included in the mandatory prelift inspection.

Some rulemaking participants argued that the standard should require a detailed inspection, including disassembly of each interbox connector (Exs. 50–7, 54–30–2, 64). For example, Albert Le Monnier, commenting on behalf of the ILWU, stated that ''[a] true inspection would require the dismantling of the SATL in order to view the internal components'' (Ex. 50–7). Without this inspection, he maintained that the most critical part of the interbox connector, the stem, which is covered by a housing, would be left unexamined. He also stated that the examination should include ultrasonic or radiographic testing as described in the ILO Code of Practice on Security, Health and Safety in Ports (Ex. 54–30–2).

On the other hand, Michael Bohlman, representing USMX, testified that a detailed inspection involving disassembly of the interbox connector is unnecessary, stating:

> The typical lock breakage, which does happen, is the result not of a tension load, but of a torsional load on the lock.
>
> For example, two containers are pried apart. When that happens, when you start to get torsion, the bending in the shaft, the lock will bind up. So typically, if you've got a lock that's partially deformed, that will bind up and you won't be able to use it well before you're going to hit a failure point in a subsequent lift operation. Cracking, per se, in the shaft between the housing is not an issue. [Tr. 1–175]

Mr. Bohlman also rebutted the need for routine ultrasonic or radiographic testing by noting that the ILO Code of Practice on Security, Health and Safety in Ports demands such testing only ''where appropriate'' (Ex. 54–3). He noted that the components that typically fail are the spring and handle mechanisms.

OSHA has concluded that, while a detailed inspection of interbox connectors before use in a VTL is necessary, disassembly and testing of these devices is unnecessary, as well as impractical. As Mr. Bohlman noted, the components that fail can typically be inspected readily without the need to disassemble an interbox connector or subject it to laboratory testing. In addition, disassembly of the connector introduces the possibility of improper reassembly, which could create hazards. The Agency does not believe that the risk of introducing these hazards is justified by the risk of cracking in areas not visible without disassembly. Thus, the final rule requires the inspection to ensure that interbox connectors are free from obvious structural defects. The inspection must include a check of the physical operation of each interbox connector to determine that the lock is fully functional with adequate spring tension on each head and a check for excessive corrosion and deterioration. These checks will ensure that each interbox connector is safe for use in a VTL.

Some commenters urged OSHA to require interbox connectors to be marked with the date of the last inspection or the period for which it was valid (Exs. 44–1, 51–4).

The Agency has concluded that requiring the inspection to be performed immediately before the VTL eliminates the need to mark inspection periods or dates on interbox containers or containers. The employees performing the operation will either see the inspection take place or will be able to ask those responsible whether it has been performed.

The ILWU also touched on the need to train employees performing inspections (Exs. 43–10, 43–10–3, 50–7, 64). Douglas Getchell, speaking on behalf of the IWLU, stated that ''[o]nly the obvious wrecks are likely to be identified by the average longshore worker'' (Ex. 43–10–3).

OSHA agrees that only employees trained in inspecting containers, corner castings, and interbox connectors would be able to detect anything other than the most obvious defects. The standard's requirement for thorough examinations of these VTL components demands that employees performing inspections be capable of detecting defects or weaknesses and be able to assess their importance in relation to the safety of VTL operations. Thus, the final rule requires this in § 1917.71(i)(9)(i).

Paragraphs (i)(9)(ii) and (i)(9)(iii)of § 1917.71 in the final rule sets the parameters that visual inspections must meet. Inspections must include:

1. A visual examination of each container, interbox connector, and corner casting to be engaged with the interbox connector for obvious structural defects. Obvious structural defects, such as those shown in the photographs submitted by the ILWU (Ex. 43–10–4), would clearly threaten the safety of a VTL.

2. A check of the physical operation of each interbox connector to determine that the lock is fully functional with adequate spring tension on each head. Michael Bohlman stressed that this was one of the key items an inspection should address (Tr. 1–113). If the interbox connector is not functioning properly or if the spring tension is inadequate, the lock may not fully engage, lowering the safe working load of the corner casting-interbox connector assembly as noted previously in this section of the preamble.

3. A check for excessive corrosion and deterioration. Excessive corrosion and deterioration can weaken containers, corner castings, and interbox connectors (Ex. 41; Tr. 2–254).

4. A visual examination of each corner casting to ensure that the opening to which an interbox connector will be connected has not been enlarged and that welds are in good condition. Defective welds can weaken containers (Tr. 1–45, 1–266), and enlarged openings can lead to load-bearing surface areas that are too small.

Paragraph (i)(9)(iv) of § 1917.71 in the final rule requires the employer to establish a system to remove damaged and defective interbox connectors from service. Paragraph (i)(9)(v) of § 1917.71 in the final rule requires defective and damaged interbox connectors to be removed from service and not used for VTLs until repaired. These provisions were taken from the last sentence of proposed § 1917.71(l)(1)(iii), which would have required defective interbox connectors to be removed from service. No comments were received on this provision in the proposal. However, rulemaking participants discussed several ways of separating damaged and defective twistlocks from good ones, including disposing of bad ones (Tr. 2–363) or placing them in a separate bin (Tr. 1–156, 2–125, 2–144). However, there was also evidence that longshore workers place bad interbox connectors in bins reserved for good ones, particularly if there was nowhere to place the defective ones (Tr. 2–167, 2–287, 2–422). Thus, the Agency has concluded that employees need a system in place that will enable them to separate damaged and defective interbox connectors from good ones. Paragraph (i)(9)(iv) of § 1917.71 in the final rule adopts a requirement for employers to establish such a system.

Paragraph (i)(9)(vi) of § 1917.71 in the final rule prohibits lifting containers with a damaged or defective corner casting in a VTL. The proposal had no counterpart to this requirement. OSHA has included it in the final rule as a necessary complement to the final rule's requirement to inspect containers and corner castings. Without such a requirement, the inspection of containers and corner castings would not be effective in preventing the lifting of unsafe containers. It should be noted that existing § 1917.71(g)(2) requires any intermodal container found to be unsafe to be identified as such, promptly removed from service, and repaired before being returned to service.

As noted earlier, platform containers are those that are open on the sides and top, but have panels on both ends. These end panels are either fixed or can be folded flat with the floor of the container. The final rule, in § 1917.71(i)(10), prohibits lifting platform containers as part of a VTL. The rationale behind this provision is explained earlier in this section of the preamble under the issue entitled ''Platform containers.''

6. Transporting Vertically Coupled Containers

Paragraph (j)(j) of § 1917.71 in the final rule addresses transporting vertically coupled containers. Moving two containers on marine terminal equipment, such as flatbed trucks and bomb carts, can raise the center of gravity higher than the equipment was designed for, increasing the possibility of overturning. To help prevent this, paragraph (j)(1) requires equipment used to transport vertically connected containers to be specifically designed to handle the connected containers safely or evaluated by a qualified engineer and determined to be capable of operating safely in this mode of operation.

Proposed § 1917.71(i) defined a qualified person as ''one with a recognized degree or professional certificate and extensive knowledge and experience in the transportation of vertically connected containers who is capable of design, analysis, evaluation and specifications in that subject.'' OSHA has not included this provision in the final rule. The intent of the proposed provision was to require a qualified engineer (that is, one with a degree or license in a field of engineering related to the safe design of mechanical equipment, such as mechanical engineering) to perform the evaluation of equipment used to transport vertically coupled containers if the equipment being used to transport the vertically connected containers was not specifically designed for this purpose. The final rule contains an equivalent requirement in the text of § 1917.71(j)(1).

Safe transport of vertically connected containers and safe operating speeds are part of the transport plan required in final § 1917.71(j)(2). This paragraph requires that a written transport plan be developed and implemented to facilitate the safe movement of vertically connected containers in a marine terminal. The plan must include safe operating speeds, safe turning speeds, and any conditions unique to the terminal that could affect the safety of the VTL operations. As noted earlier in this section of the preamble, employers may use the method in the ICHCA guidelines to calculate safe operating speeds for transporting vertically connected containers at a terminal. This paragraph and the rationale behind it are further explained earlier in this section of the preamble under the issue entitled ''Coordinated transportation.''

Paragraph (k) of § 1917.71 in the final rule addresses safe work zones. This provision requires employees to be clear of the safe work zone when vertically connected containers are being transported to protect the employees in case the containers fall or overturn or a VTL fails during a lift. This safe work zone is not required when vertically connected containers are not in motion. (However, it should be noted that existing §§ 1917.71(d)(2) and 1918.85(e) prohibit employees from working beneath suspended containers.) Paragraph (k) of § 1917.71 in the final rule requires the employer to establish a zone that is sufficient to protect employees in the event that a container drops or overturns. The standard also requires the transport plan to specify the safe work zone and procedures to ensure that employees are not in this zone when vertically connected containers are in motion. This paragraph and the rationale behind it are further explained earlier in this section of the preamble under the issue entitled ''Safe work zones.''

7. Longshoring

OSHA had proposed separate requirements for VTLs under the longshoring standards in part 1918 (64 FR 54298, 54317). The proposed requirements for part 1918 dealt only with interbox connectors used in VTLs. The proposal for part 1918 did not repeat the other VTL requirements proposed in part 1917 (marine terminals), such as limiting VTLs to two containers connected vertically and imposing a load limit of 20 tons. The marine terminal provisions, however, would have supplemented the interbox connector requirements in the longshoring portion of the proposal.

In the final rule, the Agency has in part 1918 simply incorporated by reference the final VTL requirements from the marine terminal standards in part 1917. This will clarify that VTL operations must comply with the same set of requirements regardless of whether part 1917 or part 1918 applies.

It should be noted that VTL operations must be performed using cranes meeting final § 1917.71(i)(4). As noted earlier, this provision requires cranes other than shore-based container gantry cranes to:

(1) Have the precision control necessary to restrain unintended rotation of the containers about any axis;

(2) Be capable of handling the load volume and wind sail potential of VTLs; and

(3) Be specifically designed to handle containers.

A ship's crane may be used for VTL operations only if it meets these criteria.

VI. Final Economic Analysis and Regulatory Flexibility Analysis

The Occupational Safety and Health Act of 1970 requires OSHA to demonstrate the technological and economic feasibility of its occupational safety standards. Executive Order (E.O.) 12866 and the Regulatory Flexibility Act (RFA) require Federal agencies to analyze the costs, benefits, and other consequences and impacts, including small business impacts, of their regulatory actions. Consistent with these requirements, OSHA has prepared this Final Economic Analysis (FEA) to accompany this final standard. The final standard on vertical tandem lifts establishes safe limits and work practices for employees while transporting two empty intermodal containers connected at their corners with interbox connectors. The final standard applies to the transport of VTLs between ship and shore, as well as VTL-related operations within marine terminals.

The Agency has determined that this is neither an economically significant action under E.O. 12866 or a major rule under the RFA. As required by the RFA, the Agency has assessed the potential impacts of the final standard on small entities. This rule is not a significant Federal intergovernmental mandate, and the Agency has no obligations to conduct analyses of this rule under the Unfunded Mandates Reform Act of 1995.

This analysis will present the profile of affected industries, a summary of economic benefits and costs, and the Agency's feasibility determinations. The analysis will then address several related economic issues that were brought up during rulemaking: the productivity advantage of VTLs of three tiers of containers; occupational safety standards as a barrier to trade; and the impact of the final standard on port competitiveness, congestion, and ''productivity necessities.''

The Agency received virtually no comment in the record on its preliminary economic analysis. There was considerable comment on productivity effects made possible by VTLs, however.

A. Industrial Profile

Table 2 identifies the affected industries and describes some of the characteristics of employers potentially affected by the final VTL standard.

TABLE 2—INDUSTRIAL PROFILE

	NAICS 488310 port & harbor operations	NAICS 483111 deep sea freight transportation	NAICS 483113 coastal & Great Lakes freight transportation	Total all affected sectors
All Establishments	212	507	301	1,020
Employees (ee's)	6,037	15,663	8,393	30,093
Revenues	$643,203,331	$15,455,878,053	$4,270,754,490	$20,369,835,874
Profits (7% of revenues)	$45,024,233	$1,081,911,464	$298,952,814	$1,425,888,511
Establishments with fewer than 20 ee's	179	379	223	781
Employees	850	2,152	223	3.225
Revenues/estab.	$571,677	$3,802,768	$3,023,502	
Profits/Establishment	$40,017	$266,194	$211,645	
Establishments w/100 to 499 Employees	5	36	15	56
Employees	1,052	6,575	3,293	10,920
Revenues/estab.	$77,808,832	$155,591,006	$39,740,515	
Profits/establishment	$5,446,618	$10,891,370	$2,781,836	
Establishments more than 500 ee's	3	5	2	10
Employees	3,231	3,388	1,400	8,019
Revenues/estab.	$33,305,333	$301,600,000	$357,800,000	
Profits/establishment	$2,331,373	$21,112,000	$25,046,000	

Source: Office of Regulatory Analysis.
Profit rates taken from Robert Morris Associates, 1998–1999 (RMA, 1998).
Employees, establishments, and revenues taken from Dunn & Bradstreet, 2002.

B. Potential Cost Savings (Benefits) of the Standard

In the preamble to the proposed standard, the Agency presented a model of VTL operations that described the productivity and cost savings of VTLs of two empty containers (68 FR 54308–11). The Agency identified several sources of cost saving, all of which resulted from loading and unloading two empty containers in less time using VTLs. The sources of cost savings included less longshoring employee time, less crane rental time, less dock rental time, and less total time for the ship to be idle in port. (Higher efficiencies also affect terminal and port capacity, an issue that is discussed below, but not one that directly bears on the standard's impact on employers.) The model estimated the time saved—about 4 hours—in loading or unloading one-third of 1,000 above-deck containers on a 3,000-container vessel. [The average container ship capacity was about 3,200 20-foot containers in 2004, increasing from about 2,800 in 2001 (U.S. Maritime Administration, ''Containership Market Indicators,'' 2005).] In the Agency's model, moving empty containers singly resulted in 30 containers moved per hour; moving 2 containers in a VTL moved 45 per hour; and moving 3 containers in a VTL resulted in an estimated 55 moved per hour. In OSHA's model, overall cost savings from transporting VTLs between a typical ship and shore were $3,245-plus almost 4 hours saved in idle vessel time and port rental charges. The Agency is not presenting the full model again here because it was illustrative of a positive productivity effect.

In the Preliminary Economic Analysis, employers with stevedore operations were estimated to have annualized compliance costs of $4,000 (68 FR 54313) to perform VTLs in compliance with the proposal. The Agency received no comment on this figure and concludes that it is a reasonable estimate of the annual costs. The expected cost savings of using VTLs on a single vessel are then nearly equal to employers' estimated annual compliance costs of performing VTLs.

To estimate overall cost savings from performing VTLs (benefits due to the final standard), the Agency would need both an estimate of the cost savings per ship and the number of ships that will be loaded via VTLs. The Agency's model and testimony in the record on the productivity gain of VTLs (discussed below) provide an estimate of the cost saving per ship. But the Agency cannot predict well how many ships will have empty containers loaded as VTLs. For example, most of the containers loaded onto ships at West Coast ports today are empties, but no VTLs are currently performed there, even though permitted by a letter of interpretation from the Agency. In addition, changing trade flows between the U.S. and other countries continually alter the relative number of empty containers loaded on and off ships. If trade were perfectly evenly balanced between the U.S. and its trading partners, by port, there would be little transport of empty containers. In contrast, a few years ago as much as two-thirds of all outbound containers from West Coast ports were empties; whereas today the fraction has fallen to one-half (see for example, *http://www.portoflosangeles.org/maritime/stats.org*). If promulgation of the final standard results in an increase in VTLs, these benefits could properly be attributed to the final standard. The Agency can say with some certainty that it expects cost savings of VTLs to exceed employer costs, but cannot present an exact estimate of how the affected industries will respond to the final standard, which only permits and does not require VTLs of empty containers.

Many commenters to the record reported that there is increased productivity (time saved) from moving containers via VTLs (for example, Exs. 47–5, 50–9–1, 54–3, 54–14, 1998–Tr. 125, 139, 179, 209; Tr. 2–77, 2–99). Most commenters did not provide a quantitative measure of the economic savings from VTLs.

James MacDonald of Maher Terminals said that on a weekly basis when lifting 2,200 containers as VTLs, or 10 percent of all lifts, ''overall productivity will increase by more than 1.0 container lifts per hour [and] a single container per hour increase in productivity can improve a vessel's dispatch time by 3 or 4 hours'' (Ex. 50–9–1). In oral testimony Joseph Curto, representing the National Maritime Safety Association, said:

> Let's say the crane is doing 25 lifts an hour as normal service, and in a VTL, you are doing 20 lifts per hour, because it is a little slower. So you had a reduction in the number of crane cycles, maybe by 20 percent, but you are now lifting containers at a rate of 40 an hour, versus 25 an hour, which is an increase of 40 percent. [Tr. 2–178]

Bill Williams, also representing NMSA, said:

> [I]t is generally agreed that there is about an eight percent improvement [overall] in productivity by doing vertical tandem lifts * * * the ports that do VTLs on the East Coast generally have moves per hours of 40–plus per terminal, per crane. This is compared to 30 moves an hour on the West Coast where they're not done. That's a significant difference in productivity. [Tr. 2–177]

These estimates are broadly consistent with the estimates of OSHA's model for productivity improvements associated with the use of VTLs. OSHA estimated about a 4-hour improvement in ships' dispatch times. Mr. MacDonald of Maher Terminals estimated 3 to 4 hours. Mr. Williams of Maersk noted an improvement in the number of containers transported from 30 each hour with single-box lifts to 40 per hour via VTLs. OSHA's model estimated an improvement in rate from 30 to 45 per hour.

Several commenters asserted that VTLs have not been performed following all the safety steps outlined in the ''Gurnham letter'' (Exs. 10–9, 43–10). One commenter also noted that it is not feasible or possible to follow all of the steps (Ex. 43–10–3). Two commenters, for example, concluded that if all the required safety steps were followed there would be no increase in productivity (Exs. 10–9, 50–7).

In comments to the rulemaking record, many employers and experts reported that VTLs are currently being performed and have been for many years (for example, Exs. 47–5, 50–9–1, 50–13, 54–3, 54–14; 1998–Tr. 209). The Agency believes that this is clear evidence that, overall, VTL operations result in cost-saving to stevedores and shippers, or in regulatory terms, that the economic benefits exceed compliance costs, resulting in a net benefit. Ultimately, this cost saving will lower the costs of transport, and therefore presumably prices to consumers. The cost savings directly reduce shippers' costs. There are other likely economic effects. When capital (ships, ports, and terminal facilities as well as cranes) is used more intensively or productively, economic theory predicts that this will result in a larger return to capital. Likewise, when labor productivity increases, as it does here, wages are also predicted to increase in standard economic models of competition. The Agency has not estimated or quantified any change in transportation costs, consumer prices, wages, or return on capital.

In summary, both OSHA's model and industry experience show that the standard has the potential to save shippers' costs by reducing the time necessary for transporting empty containers. Further, in situations when VTLs are not advantageous, the employer need not use them and will not incur any of the associated costs of the standard.

The Agency can estimate the range of potential benefits of employing VTLs. Currently, as described below, the Agency believes that on the East and Gulf Coasts about 165,000 VTLs are performed annually. Based on the Agency's model, this would generate about $3.2 million in cost saving [(165,000 VTLs/166.5 VTLs per ship) x $3,245 cost saving per ship). This estimate does not include savings in crane rental time, dock rental fees, port charges, idle ship time, or other sources. It is based on one-third of 1,000 above-deck containers being moved as VTLs. It is worth noting that if all above-deck containers are empty, and moved as VTLs, the estimated cost saving per ship is nearly $10,000, or about three times more than estimated by OSHA's model.

As a measure of the potential impact of the final standard, if West Coast ports began moving empty containers as VTLs there could be substantial benefit. The busiest West Coast ports (Los Angeles/Long Beach, San Francisco, Seattle, and Tacoma) have about 6,500 container vessel calls each year (U.S. Maritime Administration, ''Vessel Calls at U.S. Ports, Snapshot, 2006''). In addition, these West Coast ports import over 10 million loaded 20-foot equivalent units (TEUs) from Asian destinations while exporting about 4 million (U.S. Maritime Administration, ''Container Ship Market Indicators, August, 2005''). Over one-half of containers are now transported by ''Post-Panamax'' container ships, which have capacities over 4,000 TEUs. Where in 2001 there were 331 such vessels representing about 30 percent of total world containership capacity, by 2007 Post-Panamax-size ships constitute over one-half of world containership capacity (''Containership Market Indicators,'' U.S. Maritime Administration). Clearly, there are both the means to carry large numbers of empty containers on deck from West Coast ports as well as large numbers to carry. If only about one-half of current exported empty containers are carried above deck, the potential savings are about $30 million annually (3 million empty containers multiplied by about $10 saved per container). Again, these cost savings do not include savings from other sources (idle ship time, port charges, crane rental time, etc.).

C. Potential Costs of the Standard in the Form of Increased Safety Risk

OSHA has determined that, with full compliance under the final rule, no future injuries or fatalities are expected to occur while performing VTLs, and thus has not included such costs in this analysis. As explained elsewhere in this preamble, the final rule is more protective than current practice under the Gurnham and Matson letters, and OSHA believes that by promulgating a VTL regulation, employers will comply with OSHA's more protective and safer VTL requirements. Also the record shows that employers have engaged in a substantial number of VTLs under the Gurnham and Matson letters, and only a few reported incidents—and no deaths or injuries resulting from them. As explained elsewhere in this preamble, OSHA believes these incidents are evidence of the risks of unregulated VTLs, and support, along with other evidence in the record, the final rule. OSHA believes that these incidents would have been avoided, or at least presented little threat to workers, had the practices required by the final rule been followed.

Several commenters said that VTLs are unsafe, arguing that the number of VTLs attempted is small relative to the number of containers lifted singly each year—and therefore constitute too small a sample to evaluate the relative safety, or risk, of VTLs. For example, one commenter said that ''the amount of vertical tandem lifts made thus far is statistically insignificant'' (Ex. 43–20–3). Tests of statistical significance are based on sample size and require a hypothesis (parameter value) to be tested as well as statistical assumptions about distributions to be a meaningful statement; thus the Agency cannot evaluate this claim of (a lack of) significance. Several commenters also compared the number of VTLs performed to the total number of containers transported each year (currently about 25 million TEUs), suggesting that the number of containers transported as VTLs is too small to judge the relative safety—or risk—of VTLs.

The number of VTLs performed since 1986 is substantial in absolute terms. Several commenters reported on the number of VTLs performed by their companies:

• APM Terminals (Exs. 30–13–1, 50–13). In 2003, more than 60,000 VTLs. Since 1998, more than 380,000 VTLs.

• Maher Terminal, Port of New York (Ex. 50–9–1). In 2003, performing 250 VTLs per week, or about 12,500 per year, soon to increase to 1,100 per week.

• Michael Bohlman (Horizon Lines including former Sea-Land, Ex. 54–3). ''[W]e have the operational experience of lifting hundreds of thousands of vertically coupled containers.'' Sea-Land reported performing over 250,000 VTLs in OSHA's one-day public hearing (1998–Tr. 179) and about 50,000 VTLs per year (Ex. 11–7C).

• Richard Buonocore, Matson (1998–Tr. 169). In 1998 Matson reported performing 47,000 VTLs since 1986 between Oakland and Honolulu, although this practice apparently ended some years ago.

• Tropical Shipping and Birdsall (Ex. 54–14). More than 20,000 VTLs within the past four years (up to 2004), or about 5,000 VTLs per year.

Based on this information, the Agency estimates that these companies are performing about 165,000 VTLs annually. Other commenters reported that they are performing VTLs, but did not provide any data on the number performed. VTLs are currently performed in the U.S. only at ports on the East and Gulf Coasts (Tr. 2–232). Table 3 presents data about container traffic in East and Gulf Coast ports in TEUs for 2006, including exports, imports, and net exports. Large discrepancies in net exports, whether positive (exports greater than imports) or negative, indicate possible flows of empty containers in the opposite direction. For example, Maher Terminals (Tr. 2–81, 2–97, 2–103) reported large numbers of VTLs, and comment in the record indicated that these VTLs largely consisted of loading empty containers onto ships, as the number of loaded, imported containers is much greater than that of loaded containers for export in the ports of New York/New Jersey (Table 3). However, net exports from Gulf and southern East Coast ports are often positive, suggesting that these ports have significant numbers of empty containers returning on inbound ships. Even when a port has a significant difference between the number of loaded containers inbound and outbound, there are usually empty containers being returned in the unexpected direction. For example, in 2004 the Port of Seattle exported over 800,000 TEUs and imported about 500,000 (Port of Seattle, Internal Statistics). The port reported loading 250,000 empty containers outbound, as one would expect, but still had almost 60,000 empty TEUs arrive for unloading as well.

The Agency concludes that, although some employers performing VTLs presented specific estimates for their companies in the rulemaking, it is likely that there are other stevedores moving empty containers as VTLs in the same ports. The Agency concludes that a reasonable estimate of the number of VTLs performed since Matson began the practice in 1986 and since the Agency's ''Gurnham letter'' in 1993 is approximately one million VTLs. To put this in TEU units, a VTL of two 20-foot-long containers has two TEUs and a VTL of two 40-foot containers has four TEUs. Based on a simple assumption that about one-half of VTLs are done in each size category, the Agency estimates that the average VTL is moving three TEUs. The Agency therefore estimates that, using the metric of TEUs, VTLs have moved about 3 million TEUs. The historical total of VTLs (since 1986) is thus about 12 percent of the current annual transport of intermodal containers (about 25 million TEUs in 2005), and the Agency concludes that this is a sufficient sample with which to evaluate the safety, or risk, of VTLs.

A review of fatality-catastrophe data in OSHA's IMIS database reveals that at least 25 fatalities have occurred in the marine cargo handling industries while moving single (loaded as well as empty) containers via cranes since 1996. In these data, there are also 15 formal reports of injuries during these operations. In most cases, longshoremen are knocked off of heights by containers or spreader beams, crushed by containers in the holds of ships, or crushed by a container lowered onto the dock or ship. In addition, longshoremen have been killed even when single, empty containers have dropped from a gantry crane's spreader beams (59 FR 28596). In an extensive benefits analysis for the Agency's comprehensive overhaul of its longshoring and marine terminals standard in 1997, the Agency estimated that there were about 18 fatalities occurring annually in the industry (62 FR 40190). Most of these resulted from ''traffic'' accidents within terminals, falls from containers, and accidents involving container equipment within the terminal. In terms of the relative risk within the industry, VTLs appear to be a safer operation than other longshoring activities. Similarly, compared to risks of transporting single containers, whether containers are loaded or unloaded, the number of VTLs is sufficient to conclude that it is a relatively safe procedure. The Agency therefore has determined that there is sufficient evidence (number of VTLs) to conclude that (full compliance with) the final standard permitting VTLs will not result in any additional expected fatalities.

Commenters also said that the ''small'' sample reported of VTLs was further flawed:

> In addition, maritime industry employers never fully complied with the minimal requirements set forth in the Gurnham Letter. Non-observance was due, in part, to the fact that compliance with all eight requirements was not even feasible. * * * Thus, it is clear that even under the wide latitude granted to employers by the Gurnham Letter, employers have been requiring workers to perform inherently unsafe VTL operations outside OSHA's restrictions with impunity * * * As such the ''industry experience'' upon which OSHA heavily relies is wholly flawed and cannot serve as a legitimate basis to support the proposed rule. [Ex. 43–10] * * *

Presumably ignoring OSHA-required safety precautions would have resulted in VTLs of greater risk. However, since few accidents have been reported and there have been no employee injuries, drawing conclusions of safe outcomes from a riskier than expected sample only argues more strongly in favor of the safety of VTLs under the final standard.

Some commenters said that VTLs are performed widely around the world (Exs. 100–X, 101–X, 102–X, 103–X). However, when commenters were asked to identify specific countries and ports only a few were named (Italy, Spain, Singapore and ports in the Far East, Tr. 1–159). There were comments and testimony in the record that VTLs are not performed in Singapore, Rotterdam (Netherlands), Belgium, Russia, Canada, and Japan (Ex. 62, Tr. 2–285, 2–295).

The Agency concludes that given the number of VTLs performed with no resultant injuries, the additional protections provided by the final rule, and increased compliance following its promulgation, the Agency can reasonably conclude that operations under the final standard (that is, in full compliance) can be expected to avoid injury to longshore workers.

TABLE 3—U.S. WATERBORNE CONTAINER TRAFFIC BY U.S. CUSTOM PORTS

[East Coast and Gulf Ports (TEU's)]

U.S. Custom Ports	2006 exports	2006 imports	Exports less imports
New York, NY	1,049,918	2,578,829	(1,528,911)
Savannah, GA	718,647	862,278	(143,631)
Charleston, SC	618.095	875,190	(257,096)
Houston, TX	613,999	654,165	(40,166)
Norfolk, VA	579,728	830,005	(250,277)
Port Everglades, FL	338,603	295,627	42,976
Miami, FL	315,594	427,761	(112,167)
Baltimore, MD	150,244	253,088	(102,844)
West Palm Beach, FL	115,959	33,223	82,737
Jacksonville, FL	103,906	47,922	55,984
New Orleans, LA	102,094	68,104	33,990
Gulfport, MS	64,392	97,213	(32,821)
Boston, MA	60,228	78,877	(18,649)
San Juan, PR	55,726	151,788	(96,062)
Wilmington, NC	47,666	79,212	(31,546)
Chester, PA	45,641	50,727	(5,087)
Wilmington, DE	43,862	126,168	(82,306)
Newport News, VA	30,431	43,127	(12,696)
Anchorage, AK	28,231	120	28,110
Freeport, TX	27,982	26,662	1,320
Philadelphia, PA	27,811	152,331	(124,521)
Honolulu, HI	26,876	24,367	2,508
Panama City, FL	22,272	21,885	387
Mobile, AL	19,177	24,541	(5,364)
Richmong-Petersburg, VA	17,766	20,523	(2,757)
Mayaguez, PR	11,797	14,863	(3,066)
Fernandina Beach, FL	11,137	7,480	3,657
Camden, NJ	9,097	971	8,126
Tampa, FL	5,347	10,592	(5,245)
Fort Pierce, FL	2,194	1,423	771
Galveston, TX	1,726	6,335	(4,608)
Kodiak, AK	1,014	4,684	(3,671)

Source: Dept. of Transportation, Maritime Administration, ''U.S. Waterborne foreign Container Trade by U.S. Custom Ports, 1997–2006.'' at *http://www.marad.dog.gov/MARAD1statistics.*

D. Other Costs of the Final Standard

In its proposed standard the Agency had required a visual inspection of interbox connectors before each use (§ 1917.71(f)(3)(l)(iv)). In the final standard, the inspection immediately before each use must include a check of each connector's ''physical operation to determine that the lock is fully functional with adequate spring tension on each head,'' as well as other checks for corrosion and structural defects. Such inspections cannot be performed while the interbox connectors are attached to the containers. Thus, an individual inspection of the *operation* of interbox connectors before each use in a VTL is likely to make the discharge of VTLs from the decks of ships impractical, the Agency concludes. Each empty (top) container potentially used in a VTL would have to be raised and its four connectors removed for inspection. The connectors would have to be re-inserted in the bottom corners and the container raised by the crane and vertically coupled to another empty container to make up the VTL. This activity would have to be carried out by longshoremen working either on the deck of the ship, on a ship's hatch cover, or up on the stacks of empty containers. Working at heights puts longshoremen at increased risk of falls, and, in any event, this inspection would add so much time to the transport of empty containers as to likely save little time, or even be slower, than lifting single containers, the Agency concludes, thereby eliminating any potential productivity benefit.

Thus, employers who currently discharge empty containers from ship to shore may suffer a productivity loss under the final standard. Such affected employers would be found on the East Coast and Gulf Coast, as VTLs are not performed on the West Coast. Several commenters to the record noted that they are performing VTLs as discharges from ships (Exs. 50–13, 50–13–1, 54–14, 58; Tr. 1–291—1–307, 2–106).

Table 3 presents information about exports and imports of containers from these ports (East and Gulf Coasts). Ports that have substantial numbers of net container exports—more than 10,000 per year, the Agency estimates—would likely have sufficient ships returning with enough empty containers that are now unloaded as VTLs. The right-most column in Table 3 identifies ports with such numbers of positive net exports. For example, Port Everglades, Florida, exports about 43,000 more TEUs than it unloads as imports, and so long as most containers return via the same shipping route, the Agency believes stevedores would likely unload some of these as VTLs. (However, as explained above, even ports with large net imports also import some empty containers.)

As can be seen in Table 3, there are a total of about 215,000 more exported, loaded TEUs from Gulf and East Coast ports than are imported, and thus could be currently unloaded from container ships as VTLs. Some of the companies that reported specific numbers of VTLs, noted above in this final economic analysis, currently operate from southern ports with more than 10,000 TEUs of annual net exports (such as Birdsall, Horizon, APM). Not all returning empty containers will be transported as VTLs. If there are relatively few empty containers on a smaller vessel, it is unlikely that normal discharge operations of single, empty containers would change to a different mode of operations in the terminal. Also, empty containers stored below decks cannot be transported as VTLs because they are not coupled together with interbox connectors. Based on an assumption that one-third of the current returning empties may be moved as VTLs, the Agency estimates that about 70,000 per year are moved as VTLs from ship to shore. The Agency estimates that the productivity loss of moving these containers as single lifts to be about $700,000 annually. (In its estimate of the productivity benefit of moving VTLs above, the Agency estimated that moving 333 empty containers as VTLs would result in a saving of $3,245, or about $10 saving per container.)

This dollar total represents additional stevedoring costs that the Agency believes must be charged to shipping lines, or absorbed by carriers if they unload their own ships, and eventually to consumers. The Agency does not expect the additional costs of only being able to lift empty containers one at a time off of ships' decks will significantly impact any stevedore's revenues or profits. Since unloading empty containers as VTLs cannot be performed at other U.S. ports or by other stevedores, the Agency does not believe the competitive structure or balance of stevedore employers will be affected.

E. Technological and Economic Feasibility

The final standard sets many conditions that must be met for VTLs to be performed safely, including requirements for: employee training, limits on wind speeds, type of crane, interbox connectors' strength and locking mechanisms, inspections of connectors and container corner castings, and a plan for handling VTLs on shore. Because all of these conditions can be met by stevedores, and in fact most are being met where VTLs are currently being performed, the Agency has determined that the final standard is technologically feasible. Similarly, the Agency's estimates of compliance costs and benefits show that there is a net economic benefit to VTLs, which is confirmed by the current (voluntary) VTL activity in several ports. As Ralph Cox of Massport put it: ''The practice must be cost effective as it has been utilized since 1993'' (Ex. 10–9, emphasis in original). Because there are positive net benefits to VTLs, the Agency therefore concludes that the final standard as it applies to VTLs of two empty containers is economically feasible. However, even if costs exceeded benefits, the practice would not be economically infeasible since the standard only permits but does not require VTLs.

The final standard does not impose any net compliance costs on any small employer. The Agency certifies that the final standard does not substantially impact a significant number of small entities.

F. An Alternative to the Final Standard: VTLs of Three Tiers of Containers

Since the Agency first considered a standard for VTLs, immediately after the comprehensive marine terminal and longshoring standards were promulgated in 1997, one aspect of the VTL issue has changed. In 1997 and 1998 the primary focus of VTLs was lifting two empty or partially loaded containers (see for example, comments from the National Maritime Safety Association Ex.10–8). In a one-day public hearing on the issue of VTLs on January 17, 1998, the subject of lifting more than two containers in a VTL did not arise (1998–Tr.). However, based on the comments received during the rulemaking from shippers and stevedores, they believe that restricting VTLs to only two containers limits the economic advantages of VTLs (Ex. 47–5; Tr. 1–102, 1–104).

Many stevedores and shippers reported in the record that VTLs of three containers are being performed (Tr. 2–98, 2–103). However, there was considerable comment in the record that West Coast ports are not performing any VTLs, of even two empty containers (Tr. 2–232). Michael Bohlman reported that his company had performed many thousands of VTLs: ''Double, triple, and even quadruple couplings have been made'' (Ex. 54–3). However, VTLs of more than two containers have apparently only been performed abroad. Mr. Bohlman says later that ''the only sanctioned VTL operations in this country are limited to two tiers so there is no recent history of performing VTLs with three tiers in the U.S.'' Comments of the International Longshore and Warehouse Union suggested that there is anecdotal information that three- and four-container lifts have been performed at some U.S. ports (Ex. 43–10).

Greater productivity gains are claimed for VTLs of three containers compared to those of two containers. In operations abroad, Mr. Bohlman commented that ''time and motion studies convinced us that a 3-tier VTL unit is actually more efficient unit to handle that a 4-tier VTL * * *. We do not wish to lose the efficiency of a 3-tier VTL unit'' (Ex. 54–3). And later he added ''We considered the operational efficiencies of the four-tier unit versus the three-tier or two-tier unit * * * and from an operational perspective, three made sense and four really didn't'' (Tr. 1–118, 1–119). Another commenter noted that it was actually faster to lift four empty stacked containers in two lifts of two containers each rather than a single life of four containers (Ex. 54–3). A number of commenters said that VTLs of three and four tiers are performed abroad and also said that handling three containers in a VTL is apparently the optimum (Tr. 1–109, 1–118, 1–119). ISO also recognized that there is ''a practical upper limit of three vertically-coupled containers'' (ISO 3874 section 6.2.5).

As discussed earlier in this preamble, the Agency has concluded based on the ultimate strength of interbox connectors and a safety factor of five, that VTLs of only two empty containers is a safe operation, but one of three or more empty containers is not [based on interbox connectors with a safe working load of 10,000 kg—§ 1917.71(i)(7)(v)]. To the extent that VTLs of three containers are presently being performed domestically, the restriction to two empty containers would impact productivity. The Agency believes that the information in the record indicates that there are today few if any VTLs at U.S. ports of more than two tiers of containers. The Agency concludes that there is no significant loss in productivity (which would be essentially a cost of the final standard) from current practices to limiting VTLs to two containers.

Nevertheless, limiting VTLs to two containers might prevent taking advantage of potential productivity gains not now enjoyed. The potential future loss in productivity is measured by the difference in productivity gains from two-container VTLs and three-container VTLs. There was little information in the rulemaking record quantifying the productivity gain of VTLs with two containers, and none at all of three-container VTLs. OSHA's model in the PEA describes a reduction in time per box moved of 33 percent when two containers are lifted in a VTL compared to single lifts. For three-container lifts, the model predicts an additional 18 percent reduction in time per box relative to two-container VTLs (68 FR 54311, Table 4b—Productivity Gains). These percentages are only for moving empty, above-deck containers and are not overall increases in the time saved in ship loading and unloading. (OSHA's model in the PEA however predicts further efficiency gains, or savings in time, with four- and five-container VTLs. As noted earlier, four-container VTLs were said by commenters to be slower than lifting via two two-container VTLs; so OSHA's model is inaccurate for VTLs of more than three containers.) The Agency believes based both upon its model and the testimony in the record that there is substantial cost savings with two-container VTLs and additional but less time saved per container with three-container VTLs.

The actual amount of time saved by three-container VTLs depends on many factors. For example, stevedores could potentially need different equipment for making up or breaking down three-container VTLs. Three-container VTLs would be more susceptible to being limited by wind speeds. The time saved is also a function of the ship's stowage plan. For example, if loading or unloading a ship with four-high stacks of empty containers on deck, there is little advantage to three-container VTLs over two-container lifts since two lifts are required in either case. If containers were stacked five high, there would be two lifts if three-container VTLs were allowed, but three lifts if only two-container VTLs were permitted.

Without information about either the actual average efficiency gain of three-container VTLs or the number that might be performed, the Agency cannot quantify this potential productivity gain. But the productivity gain is surely less, as a percentage, than that of two-container VTLs relative to single container lifts. Nor has the Agency calculated the expected number of injuries and deaths that might occur while making three-container lifts. But the Agency has made a determination that there is a significant risk that accidents and injury will occur with three-container lifts since such lifts would exceed the safe working load of (existing) interbox connector-corner casting assemblies. The Agency's evaluation of even riskier four-container lifts and industry's report that these are not practical are consistent in concluding that this is an undesirable procedure.

G. A Barrier to Trade

Several commenters said that OSHA's failure to permit more than two-container VTLs constitutes a barrier to trade—because this will limit productivity gains in handling intermodal containers (for example, Ex. 47–5). In general, a non-tariff barrier to trade is a rule that favors domestic over foreign production, particularly one applied selectively so that the rule imposes costs on foreign companies but not domestic producers. Rules that are actually necessary to achieve cost-effective safety or health measures are not generally considered barriers to trade—though it is widely recognized that safety or health rules that are cost ineffective but favor domestic producers may be barriers to trade.

The Agency believes the following facts are pertinent to claims that an occupational safety standard for VTLs is a barrier to trade:

- The United States is both the world's largest importer of goods as well as the largest exporter of manufactures.
- The final standard's safety measures apply to both foreign imports and U.S. exports without discrimination.
- The final standard also applies to containers that are shipped between domestic U.S. ports, including Hawaii and Puerto Rico.
- The limit on the number of containers in a VTL is not an artificial one designed to favor some shipper over others with no effect on safety—which would be characteristic of a barrier—but based on statutory criteria in the OSH Act.
- The ICHCA guidelines, which shippers, ports, and cargo handlers have urged OSHA to adopt, includes the following—ICHCA Guidelines 8.1.1.3: ''VTL operations should only be carried out if the domestic legislation of the country in which they are to be carried out permits such operations under appropriate conditions.''
- OSHA currently permits VTLs of two containers, but the cargo transportation industry does not perform two-container VTLs on the West Coast ports.

The claim that a safety standard for longshore employees, limiting VTLs to two containers, constitutes a barrier to trade seems to be without merit in any economic sense. Related issues about compatibility with international treaties have been discussed earlier in this preamble.

H. Congestion, Competitiveness, and Productivity Necessity

Several commenters raised issues about the final standard's effect on the competitiveness of ports and cargo-handling industries and the impact of productivity on the affected industries. For example, NMSA stated that: ''The utilization of VTLs is an absolute necessity if U.S. ports are going to remain competitive given projections for domestic cargo growth'' (Ex. 50–9–1).

When a ship's containers can be loaded and unloaded faster, it benefits the vessel owner/shipper engaged in cargo transport. It reduces the time the vessel, and crew, remain idle in port. Potentially, it also reduces the cost—ultimately born by the shipper—in dock rental, crane rental, and amount of time the longshoremen need to move the containers. The stevedore and longshore workers may or may not benefit economically from a more efficient arrangement. When the volume of container traffic becomes so large that ships must sit idle at anchor, and may therefore be forced to go to less optimal ports, then ports, marine terminals, and stevedores may lose business. This is the situation at peak periods of cargo traffic at U.S. ports today, and explains why carriers, ports, marine terminals, and stevedores all seek greater capacity at ports. Capacity is the rate at which containers can be moved back and forth between vessel and land destinations; that is, through the marine terminal. Carriers are always interested in faster loading and unloading; ports and the cargo handling industry join in the pursuit of this goal as congestion (or ships' waiting time) grows. One commenter recounted how congestion, caused by a shortage of labor at a California port, had resulted in ships being diverted to a Mexican port for unloading (Tr. 2–76).

Congestion results when port capacity and the distribution network are overwhelmed by the number of containers to be transported. The congestion results from the extraordinary growth of international trade and concomitant number of containers to be transported. Commenters described a number of infrastructure causes for congestion, including limitations of bridges and roads, environmental issues, dock space and crane availability, and labor shortages (Tr. 1–73, 1–75, 1–76, 1–140, 1–141). The container-moving industries have considerably increased capacity in the past decade, but have not yet caught up with the growth of trade—or its expected continued growth.

The ability of VTLs to speed the transport of containers between ship and shore provides one source of productivity to increase capacity. However, any increase in the rate of moving containers between ship and shore would have to be matched by the ability of other modes of transport in and out of the terminal. If the limiting factor is truck or rail transport, then increasing the speed of unloading vessels would still have benefits, but would not relieve congestion:

> It has been announced in many shipping journals that the increased volume in container traffic is exceeding the capacity of the rail and road infrastructures around the world. Vertical Tandem Lifts will not alleviate that problem. * * * VTLs may be economically beneficial to the shipping lines, but are no real gain for the terminals, railroads or trucking industry, or more importantly, the customer. [Ex. 50–7]

The ''competitiveness'' issue raised by commenters is really one of capacity, the Agency believes. Commenters did not suggest that other ports or marine terminals could provide services at lower prices because they would be able to employ larger units of VTLs. Rather the concern seems to be losing business simply because U.S. ports cannot accommodate the volume of container traffic (Tr. 2–75—2–80). Commenters did not provide any evidence to support a claim that they are at an economic disadvantage. The only realistic alternatives to moving sea-going commerce through American ports are Canadian or Mexican ports. Canadian ports do not perform VTLs on either coast (Tr. 2 295), and they therefore cannot offer any cost or time saving relative to U.S. ports. Transporting containers via Mexican ports adds greater distances for containers to reach U.S. destinations and an additional border to cross. There was no evidence in the record that transporting containers through Mexican ports lowers the cost of transport, that the diversion of ships there was due to the use of VTL operations in Mexico, or that VTLs are performed in Mexico.

Since marine terminals and the cargo-handling industry at West Coast ports do not perform two-container VTLs, as they presently are permitted to do by OSHA policy, the Agency is unsure what the industry means when it says that VTLs are a ''productivity necessity'' while still arguing that the Agency should permit larger VTLs of three containers in its final standard (Ex. 47–5). The Agency can well see that the cargo-handling industries must continue to find ways to increase capacity or more cargo will be diverted to other ports, and that VTLs can provide a part of that productivity improvement. But in response to the assertion that OSHA cannot impede a productivity necessity (Ex. 50–9–1)—the Agency can through the OSH Act constrain efficiencies and productive actions by employers if necessary to avoid a significant risk of injury and death to employees.

VII. Environmental Impact

Finding of No Significant Impact. OSHA has reviewed the final rule according to the requirements of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (40 CFR parts 1500 through 1517), and the Department of Labor's (DOL) NEPA Procedures (29 CFR part 11). Based on this review, the Assistant Secretary for OSHA finds that the rule will have no significant environmental impact.

The revisions and additions to 29 CFR Parts 1917 and 1918 focus on the reduction of employee death and injury. OSHA will achieve this reduction through the updating of its standards for longshoring and marine terminal operations to provide safe work practices for employers who choose to perform VTLs. The new language of these rules does not affect air, water, or soil quality, plant or animal life, the use of land, or other aspects of the environment. Therefore, the new rules are categorized as ''excluded actions'' according to § 11.10(a)(1) of the DOL NEPA regulations.

VIII. Federalism

OSHA has reviewed this final rule in accordance with the Executive Order on Federalism (Executive Order 13132, 64 FR 43255, August 10, 1999), which requires that federal agencies, to the extent possible, refrain from limiting State policy options, consult with States prior to taking any actions that would restrict State policy options, and take such actions only when there is clear constitutional authority and the presence of a problem of national scope. Executive Order 13132 provides for preemption of State law only if there is a clear congressional intent for the Agency to do so. Any such preemption is to be limited to the extent possible.

Section 18 of the OSH Act (29 U.S.C. 651 *et seq.*) expresses Congress' intent to preempt State laws where OSHA has promulgated occupational safety and health standards. Under the OSH Act, a State can avoid preemption on issues covered by federal standards only if it submits, and obtains federal approval of, a plan for the development of such standards and their enforcement (State plan State) (29 U.S.C. 667). Occupational safety and health standards developed by such State plan States must, among other things, be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. Subject to these requirements, State plan States are free to develop and enforce under State law their own requirements for safety and health standards.

This final rule complies with Executive Order 13132. As Congress has expressed a clear intent for OSHA standards to preempt State job safety and health rules in areas addressed by OSHA standards in States without OSHA-approved State plans, this rule limits State policy options in the same manner as all OSHA standards. In States with OSHA-approved State plans, this action does not significantly limit State policy options.

IX. Unfunded Mandates

This final rule has been reviewed in accordance with the Unfunded Mandates Reform Act of 1995 (UMRA) (2 U.S.C. 1501 *et seq.*) and Executive Order 12875. As discussed in the Final Economic and Regulatory Flexibility Analysis, OSHA estimates that compliance with the rule will require expenditures of less than $100 million per year by affected employers. Therefore, this rule is not a significant regulatory action within the meaning of Section 202 of UMRA (Pub. L. 104–4, 2 U.S.C. 1532). OSHA standards do not apply to State and local governments except in States that have voluntarily elected to adopt an OSHA State plan. Consequently, the rule does not meet the definition of a ''Federal intergovernmental mandate'' (Section 421(5) of UMRA) (2 U.S.C. 658).

X. Office of Management and Budget Review Under the Paperwork Reduction Act of 1995

The final rule on VTLs contains a collection of information (paperwork) requirement that is subject to review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (PRA–95), 44 U.S.C. 3501 *et seq.*, and OMB's regulations at 5 CFR part 1320. PRA–95 defines ''collection of information'' as ''the obtaining, causing to be obtained, soliciting, or requiring the disclosure to third parties or the public of facts or opinions by or for an agency regardless of form or format * * *'' (44 U.S.C. 3502(3)(A)). The collection of information requirements contained in the proposed VTLs was submitted to OMB on September 12, 2003.

The Department submitted an Information Collection Request (ICR) to OMB for its request of a new information collection. OMB approved the ICR on November 24, 2008, under OMB Control Number 1218–0260, which will expire on November 30, 2011.

The Department notes that a Federal agency cannot conduct or sponsor a collection of information unless it is approved by OMB under the PRA, and displays a currently valid OMB control number, and the public is not required to respond to a collection of information unless it displays a currently valid OMB control number. Also, notwithstanding any other provision of law, no person shall be subject to penalty for failing to comply with a collection of information if the collection of information does not display a currently valid OMB control number.

In the NPRM OSHA proposed that employers rely on the vessel's cargo stowage plan for the location and characteristics (weight and content) of the VTL units being handled and to provide a copy of the plan to the crane operator. Based on the rulemaking record, OSHA has concluded that this requirement is unnecessary (see the discussion of the proposed stowage plan requirement in section V.H. 4., Stowage plan, earlier in this preamble).

The final VTL Standard contains one collection of information requirement. Paragraph (j)(2) of § 1917.71 requires the employer to develop, implement, and maintain a written plan for transporting vertically connected containers in the terminal. The transport plan helps ensure the safety of terminal employees and enhances productivity. Paragraph (k)(2) of § 1917.71 requires that the written transport plan include the safe work zone and procedures to ensure that employees are not in the zone when a VTL is in motion. The Agency did receive public comments favoring the written plan. A full discussion of the written plan may be found in section V.E., Coordinated transportation, earlier in this preamble.

The final ICR estimates that 20 establishments will take 4 hours to develop the written plan totaling 80 hours. The burden hour cost to establishments for developing the written plan is $4,951. There are no capital costs for this collection of information requirement.

XI. State Plan Requirements

This **Federal Register** document issues final rules addressing the handling of VTLs in marine cargo handling regulated in 29 CFR Parts 1917 and 1918. The 26 States or U.S. Territories with their own OSHA approved occupational safety and health plans must develop comparable standards applicable to both the private and public (State and local government employees) sectors within 6 months of the publication date of a final Federal rule or show OSHA why there is no need for action, for example, because an existing State standard covering this area is already ''at least as effective as'' the new Federal standard. Three States and territories cover only the public sector (Connecticut, New York, and New Jersey).

Currently four States (California, Minnesota, Vermont, and Washington) with their own State plans cover private sector onshore maritime activities. Federal OSHA enforces maritime standards offshore in all States and provides onshore coverage of maritime activities in Federal OSHA States and in the following State Plan States: Alaska, Arizona, Connecticut (plan covers only State and local government employees), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Jersey (plan covers only State and local government employees), New Mexico, New York (plan covers only State and local government employees), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Virginia, Virgin Islands, Washington, and Wyoming. Until such time as a State standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in those States.

XII. Effective Date

The final rule becomes effective on April 9, 2009. This gives employers 120 days to establish procedures required by the standard and to train employees in those procedures.

A single rulemaking participant addressed the effective date of the final rule. Mr. Michael Bohlman, representing USMX, urged the Agency to provide a transition period ''so that existing, safe VTL operations can be made to conform to the numerous, small but new requirements that may remain in the final rule'' (Ex. 50–10–2). However, he did not estimate how long a transition period would be necessary.

The final rule requires only incremental changes from existing VTL procedures as outlined in the Gurnham letter (Ex. 2). In comparison to the restrictions imposed by the Gurnham letter, the final rule includes additional provisions limiting the type of crane that may be used in VTLs, requiring a prelift, prohibiting handling containers below deck as a VTL, limiting VTL operations in windy conditions, and prohibiting VTLs of platform containers. The final rule also contains new requirements for employee training and the safe ground transport of vertically coupled containers that were not addressed by the letter of interpretation. Lastly, the final rule contains specifications on the strength of interbox connectors used in VTLs.

The differences in procedures required by the final rule compared to the Gurnham letter are relatively minor, and employers already performing VTLs should be capable of implementing the revised procedures reasonably quickly. Thus, these differences are not a significant consideration in establishing an effective date for the final rule.

The interbox connector specifications match those imposed by the ICHCA guidelines (Ex. 41), which have been in effect since 2003. The ICHCA guidelines include certification and marking provisions equivalent to those in the final rule. Based on comments supporting the adoption of practices consistent with the ICHCA guidelines, OSHA believes that employers are already using interbox connectors meeting these requirements in existing VTL operations. Thus, the final rule's requirements relating to the strength of interbox connectors are not a significant consideration in establishing an effective date for the final rule. Thus, OSHA believes that 120 days after the publication of the final rule should be sufficient time for employers to institute the procedural requirements of the standard and has set the effective date of those requirements in the standard accordingly.

However, employers may need substantial time to implement the training requirements contained in the final rule. This training will take some additional time beyond that needed to implement revised VTL procedures. There is evidence in the record that employers who are performing VTLs are already training employees in their current procedures (Exs. 50–13, 58, 61; Tr. 1–216—1–217). Thus, employers would only need to provide training in any revisions to their VTL procedures that are required by the final rule. Although employers who are not already performing VTLs would need to provide more extensive training, these employers would only need to complete the training before commencing VTL operations rather than by the effective date of the final rule.

OSHA believes that 120 days after the publication of the final rule should be sufficient time for employers to institute the training requirements of the standard and has set the effective date of the training provision accordingly.

XIII. Authority and Signature

This document was prepared under the direction of Thomas M. Stohler, Acting Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210. It is issued pursuant to sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657), section 41 of the Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941), Secretary of Labor's Order 5–2007 (72 FR 31160), and 29 CFR 1911.

Signed at Washington, DC, this 25th day of November 2008.

Thomas M. Stohler,

Acting Assistant Secretary of Labor for Occupational Safety and Health.

List of Subjects

29 CFR Part 1917

Freight, Longshore and harbor workers, Occupational safety and health, Reporting and recordkeeping requirements.

29 CFR Part 1918

Freight, Longshore and harbor workers, Occupational safety and health, Reporting and recordkeeping requirements, Vessels.

■ Accordingly, OSHA amends 29 CFR parts 1917 and 1918 as follows:

PART 1917—MARINE TERMINALS

■ 1. The authority citation for Part 1917 is revised to read as follows:

Authority: Section 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); secs. 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 6–96 (62 FR 111), 5–2002 (67 FR 65008), or 5–2007 (72 FR 31160), as applicable; and 29 CFR 1911.

Section 1917.28, also issued under 5 U.S.C. 553.

Section 1917.29, also issued under Sec. 29, Hazardous Materials Transportation Uniform Safety Act of 1990 (49 U.S.C. 1801–1819 and 5 U.S.C. 553).

■ 2. Section 1917.71 is amended by adding new paragraphs (i), (j), and (k) to read as follows:

§ 1917.71 Terminals handling intermodal containers or roll-on roll-off operations.

* * * * *

(i) *Vertical tandem lifts.* The following requirements apply to operations involving the lifting of two or more intermodal containers by the top container (vertical tandem lifts or VTLs).

(1) Each employee involved in VTL operations shall be trained and competent in the safety-related work practices, safety procedures, and other requirements in this section that pertain to their respective job assignments.

(2) No more than two intermodal containers may be lifted in a VTL.

(3) Before the lift begins, the employer shall ensure that the two containers lifted as part of a VTL are empty.

Note to paragraph (i)(3): The lift begins immediately following the end of the prelift required by paragraph (i)(5) of this section. Thus, the weight may be determined during the prelift using a load indicating device meeting § 1917.46(a)(1)(i)(A) on the crane being used to lift the VTL.

(4) The lift shall be performed using either a shore-based container gantry crane or another type of crane that:

(i) Has the precision control necessary to restrain unintended rotation of the containers about any axis,

(ii) Is capable of handling the load volume and wind sail potential of VTLs, and

(iii) Is specifically designed to handle containers.

(5) The employer shall ensure that the crane operator pauses the lift when the vertically coupled containers have just been lifted above the supporting surface to assure that each interbox connector is properly engaged.

(6) Containers below deck may not be handled as a VTL.

(7) VTL operations may not be conducted when the wind speed exceeds the lesser of:

(i) 55 km/h (34 mph or 30 knots) or

(ii) The crane manufacturer's recommendation for maximum wind speed.

(8) The employer shall ensure that each interbox connector used in a VTL operation:

(i) Automatically locks into corner castings on containers but only unlocks manually (manual twistlocks or latchlocks are not permitted);

(ii) Is designed to indicate whether it is locked or unlocked when fitted into a corner casting;

(iii) Locks and releases in an identical direction and manner as all other interbox connectors in the VTL;

(iv) Has been tested and certificated by a competent authority authorized under § 1918.11 of this chapter (for interbox connectors that are part of a vessel's gear) or § 1917.50 (for other interbox connectors):

(A) As having a load-bearing surface area of 800 mm^2 when connected to a corner casting with an opening that is 65.0 mm wide; and

(B) As having a safe working load of 98 kN (10,000 kg) with a safety factor of five when the load is applied by means of two corner castings with openings that are 65.0 mm wide or equivalent devices;

(v) Has a certificate that is available for inspection and that attests that the interbox connector meets the strength criteria given in paragraph (i)(8)(iv) of this section; and

(vi) Is clearly and durably marked with its safe working load for lifting and an identifying number or mark that will enable it to be associated with its test certificate.

(9) The employer shall ensure that each container and interbox connector used in a VTL and each corner casting to which a connector will be coupled is inspected immediately before use in the VTL.

(i) Each employee performing the inspection shall be capable of detecting defects or weaknesses and be able to assess their importance in relation to the safety of VTL operations.

(ii) The inspection of each interbox connector shall include: a visual examination for obvious structural defects, such as cracks; a check of its physical operation to determine that the lock is fully functional with adequate spring tension on each head; and a check for excessive corrosion and deterioration.

(iii) The inspection of each container and each of its corner castings shall include: a visual examination for obvious structural defects, such as cracks; a check for excessive corrosion and deterioration; and a visual examination to ensure that the opening to which an interbox connector will be connected has not been enlarged, that the welds are in good condition, and that it is free from ice, mud or other debris.

(iv) The employer shall establish a system to ensure that each defective or damaged interbox connector is removed from service.

(v) An interbox connector that has been found to be defective or damaged shall be removed from service and may not be used in VTL operations until repaired.

(vi) A container with a corner casting that exhibits any of the problems listed in paragraph (i)(9)(iii) of this section may not be lifted in a VTL.

(10) No platform container may be lifted as part of a VTL unit.

(j) *Transporting vertically coupled containers.* (1) Equipment other than cranes used to transport vertically connected containers shall be either specifically designed for this application or evaluated by a qualified engineer and determined to be capable of operating safely in this mode of operation.

(2) The employer shall develop, implement, and maintain a written plan for transporting vertically connected containers. The written plan shall establish procedures to ensure safe operating and turning speeds and shall address all conditions in the terminal that could affect the safety of VTL-related operations, including communication and coordination among all employees involved in these operations.

(k) *Safe work zone.* The employer shall establish a safe work zone within which employees may not be present when vertically connected containers are in motion.

(1) The safe work zone shall be sufficient to protect employees in the event that a container drops or overturns.

(2) The written transport plan required by paragraph (j)(2) of this section shall include the safe work zone and procedures to ensure that employees are not in this zone when a VTL is in motion.

PART 1918—SAFETY AND HEALTH REGULATIONS FOR LONGSHORING

■ 3. The authority citation for Part 1918 is revised to read as follows:

Authority: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970, 29 U.S.C. 653, 655, 657; Sec. 41, Longshore and Harbor Workers' Compensation Act, 33 U.S.C. 941; Secretary of Labor's Order No. 6–96 (62 FR 111), 5–2002 (67 FR 65008) , or 5–2007 (72 FR 31160), as applicable; and 29 CFR 1911.

Section 1918.90 also issued under 5 U.S.C. 553.

Section 1918.100 also issued under Sec. 29, Hazardous Materials Transportation Uniform Safety Act of 1990 (49 U.S.C. 1801–1819 and 5 U.S.C. 553).

■ 4. Section 1918.85 is amended by adding new paragraph (m) to read as follows:

§ 1918.85 Containerized cargo operations.

* * * * *

(m) *Vertical tandem lifts.* Operations involving the lifting of two or more intermodal containers by the top container shall be performed following § 1917.71(i) and (k)(1) of this chapter.

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