Exploring diverse maintenance and repair standards in the container industry: a comparative analysis of criteria and practices

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ABSTRACT
The maintenance and repair standards have always been a problem in the container industry. Due to different preferences of criteria of different parties caused many conflicts. This paper examines the different types of criteria and standards for general purpose containers, and different areas of use of these criteria. The main reason of this paper is to be an explanatory element to define the differences of these criteria. The fundamental structural dimensional basis for an intermodal container is ISO container standards which defines the main structural features. Although it presents dimensional tolerances to a certain degree, it is nearly impossible to use these criteria for the operators and owners in day to day operations. As a result there have been various published maintenance and repair criteria, used by different parties partaking in the container industry. The different organizations and associations published standards suiting their own needs. Although there are lesser implemented criteria like Wind and Water Tight and Cargo Worth, the most known and most implemented criteria around the world are Unified Container Inspection and Repair Criteria, Common Interchange Criteria and IICL publications. While the Wind and Water Tight criteria is generally used for containers which are used as storage, the Cargo Worthy is used for the containers meet the minimum requirements for transport. The Unified Container Inspection Criteria is preferred by the shipping lines and operators, and the Common Interchange Criteria and IICL – 6 are preferred by lessors.

Keywords: container, criteria, inspection, repair, standards, ma.

1 INTRODUCTION
An intermodal container’s main purpose is transporting the cargo safe and effectively in an intermodal transport system. These containers should be seaworthy and withstand the challenges caused by different transport modes, variant temperatures and weather conditions. Also should endure all handling operations at depots and ports.
To keep their structural integrity in certain dimensional tolerances is vital for functionality of intermodal transport system. Although containers are made of durable materials they are not invincible to damages degenerating effects of nature. Especially a container which visit a country does not implement these criterias can be damaged heavily and generally it is impossible to trace back to the root of the damage. Therefore it becomes a financial loss and a problem for the container operators. For this reasons, container inspection criterias and applications are used for bringing out unsafe structural conditions, serviceability of the container or factors causing decrease on the lifespan of the containers both at interchange and in – service.

2 METHODOLOGY

In general containers are Closed steel box structures which have doors on one end, plywood floors, corrugated steel panels which is known as CorTen and a steel frame. The reason the steel is widely known as Corten in the industry is the inventor company US Steel Corporation registered it as a trademark. High durability and resistance against corrosion is the most important features of this steel, so it is widely used in the maritime and especially in container industry. Corrugated panels are used to improve the rigidity and strength of the container. This structural designs can also be seen at cardboard boxes which endure the hardships of shipping, handling, stacking, etc. These corrugated panels can withstand much more powerful forces than plain steel sheets.

Figure 1. Rigidity of Corrugated Steel Plates [8]

![Figure 1. Rigidity of Corrugated Steel Plates](image)

Source: Corrugated Plate Industry BV (2023)

The Figure 2 shows some examples about the rigidity of the plain steel sheet and corrugated steel. The top images compare the plain steel sheet with corrugated sheet resting on supports. The plain steel...
sheet bent under it’s own weight in contrast to the corrugated sheet which is even capable to carry more weight. The bottom figures compares the vertical durability of the both types. Once more the corrugated sheet is being shown more durable. Although the corrugated panels on a container have significant advantages on it’s durability, they increase fuel consumption levels at road and rail transportations about %10 due to higher aerodynamic drag [10].

Intermodal containers have eight corner fittings on each corner which are basically twist lock housings. As to twist locks, they are twisting locks which have flanges and used for securing the container. The main purpose of these components are anchoring the containers to the decks of ships, trailers and trains and also let handled by cranes and stackers.

The most important component of a container is it’s steel framework. The framework is the structure which carries the load and weight of the container and it consits two top and two bottom side rails, two bottom front and end side rails, a door header and a top end rail. The crossmembers which positioned between two side bottom rails all along the container are the supporting components for the floor of the container.

The floor is generally coated with plywood in containers. The wood is an expensive material but it is rather practical due to it’s easy to handle feature in repairs and durable enough to carry most detrimental cargoes. Also it offers a good enough rate of friction.

Figure 2. Container Components [11]

The doors of a container, especially on general purpose containers, are one of the most important parts of a container. The doors should be able to open a 180° at least and should fit its place properly. Also, the hinges and other door assemblies must be adjusted decently enough to let the moving parts operate. On the left hand door there must be a CSC (Container Safety Convention) plate. This plate shows all essential technical and owner data. Also it consists of ACEP (Approved Continuous Examination Programme) information which is the container examination programme every freight container must comply. According to CSC and ACEP every container being used for intermodal transport must be examined every thirty months or less. Figure 3. Below shows two examples of CSC plate which presents informations like customs seal approval number, manufacturer’s number, timber component treatment, manufacturer, owner, CSC number, container number and maximum gross weight.

2.1 RELEVANT INTERNATIONAL REGULATIONS

Containers are allowed to be operated under variable conventions, regulations and standards. These kind of international sanctions have an influencing effect on structural features on containers also. The containers built in conforming features with ISO standards and they should have a structural harmony with the allowances that is defined by relevant criterias.

2.1.1 Customs Convention on Containers, 1972

CSC is an international convention which makes transporting containers in an international environment easier. As a consequence of the rules and regulations of CSC presents, there are enforcements about structures of containers. The most basic one may be the structural feature of container doors and handles which allows the container to be sealed safely and securely under one customs seal. The most important enforcement about containers is the necessity of a CSC plate. By this plate the operators, enforcers or the inspectors can gain all relevant information about the referred container and also having
a CSC plate on a container means that container is in conformity with CSC and it is inspected for structural integrity regularly. As mentioned before, the inspection period programme referred in the CSC plate as ACEP. The owners or lines can implement their own ACEP but it must not exceed thirty months period.

2.1.2 The 1972 Convention for Safe Containers

The 1972 Convention for Safe Containers is developed by IMO in co-operation with Economic Commission for Europe. The Convention has two goals which are explained in the official site of IMO as;” one is to maintain a high level of safety of human life in the transport and handling of containers by providing generally acceptable test procedures and related strength requirements, and the other reason is to facilitate the international transport of containers by providing uniform international safety regulations, equally applicable to all modes of surface transport. In this way, proliferation of divergent national safety regulations can be avoided” [12]. The CSC has two technical annexes which provides rules and technical informations to be applied to the containers. Annex 1 sets out procedures to be applied to the containers being used in international transport which expected to be enforced by an Administration of a Contracting State or by an organization acting on its behalf and Annex 2 provides structural safety requirements and tests and details of test procedures[12].

2.1.3 The International Standards

The structural specifications of containers are established by International Organization and Standardization’s relevant standards. Up to date there have been published more than thirty standards regarding freight containers. These standards refers to all types of containers existing in the fleet in the world. The most important standards for general purpose containers are; ISO 1496- 1:1990, Series 1 freight containers – Specification and testing – Part 1: General cargo containers for general purposes and ISO 668:1995, Series 1 freight containers – Classification, dimensions and ratings which determines all other standards [13]. The containers being used in international trade should be built in conformity with these standards and the structural features and dimensions which standards compel. The Figures 4. and 5. Shows the ISO container dimensions and maximum allowable dimensional tolerances.
Figure 4. ISO Dimensions and Tolerances 1 [1]

Figure 5. ISO Dimensions and Tolerances 2 [1]

2.2 CONTAINER REPAIR AND INSPECTION CRITERIAS

The ISO tolerances are actually too strict to be functional at shipping industry. As a result, there are variable repair and inspection criterias created and published by container industry associations, chambers, organizations and/or companies. These criterias generally measure damage tolerances as “ISO dimensions + Relevant criteria tolerances”. In this section, widely used criterias will be examined.

2.2.1 Wind and Water Tight Criteria

The Wind and Water Tight Criteria (WWT) is the criteria that indicates the regarding container is simply water and weatherproof. When the container is shut tight, the observer inside the container should not be able to see any light. This criteria does not pay attention to the integrity of any important understructure or structural feature of the container. This means a WWT should not be considered safe for being used in transportations. Unless it is inspected and given a CSC certificate and plate. This criteria generally used for containers that do not comply with CSC.

WWT containers can be serviceable in transportation again with temporary repair methods. Generally they have full operable doors and minimum level of damage or repair costs. This criteria is widely used to inspect the storage containers.

2.2.2 Cargo Worthy Criteria

Cargo Worth (CW) indicates that the container meets all the standards of it’s original specifications and suitable for transportation and generally the container has a valid CSC [6]. CW is in compliance with ISO. CW containers must meet WWT standards and minimum structural requirements. CW containers with CSC certificates are suitable for overseas transportations. The inspectors examine the container if it is WWT and surveys the structural strength of the container. The containers get exposed to many physical and corrosive effects and damages during transportation. If the damages they suffered do not prevent them to carry the cargo safely, the container is considered CW.

New built containers have five years of exemption from inspection for CW. Containers older than five years must be inspected by a licensed surveyor regularly. After the inspection the surveyor prepares a certificate regarding the condition of the container and estimates when the next inspection should occur.

2.2.3 Unified Container Inspection and Repair Criteria

The Unified Container Inspection and Repair Criteria (UCIRC) is a criteria especially designed by International Chamber of Shipping for the specific needs of the shipping lines which are preventing unnecessary repairs and movements and by doing so reducing the repair costs for shipping lines, lessors, and repair depots. In contrast to IICL-6, UCIRC is more practical for the container operating parties. It
suits with the basic needs of the shipping lines, operators and etc. about daily maintenance and repairing
their own fleets. This criteria allows users a faster response chance in spite of CIC and IICL – 6. Although
container operators mainly use the UCIRC, while off-hire procedures they prefer to repair existing
damages according to CIC or most commonly IICL – 6. The damage types in UCIRC is defined broadly
as below;

- Acceptable Damage
- Non-Acceptable Damage
- Wear & Tear
- Manufacturing Defects

2.2.4 Common Interchange Criteria

The Common Interchange Criteria (CIC) is the criteria prepared and published by Container
Owners Association (COA). It is designed to reduce the repair and maintenance costs and bring a more
environmentally friendly approach. In recent years, CIC has gained acceptance by the lessors managing
nearly %50 of world dry van container fleet [14]. CIC and IICL-6 both are criterias mainly appealing to
lessors. Due to complications caused by two different criterias in the industry, COA accepted a new
interchange standard, uniforming the CIC with IICL-6. The new standard entered into force in August 1\textsuperscript{st}
2016. Although the new standard does not have major changes, it is considered that it will bring ease to
the industry.

CIC is generally based on UCIRC and IICL-6. By harmonizing these two criterias, it is predicted
that the efficiency of the repair depots will increase and the repair costs will be reduced. This criteria is
generally used for On-Hire and Off-Hire operations. By using this criteria the lessee can be comfortable
about the condition of the container while hiring one. Also when off-hiring one, the lessee would be able
to know which condition level the container must be delivered and can estimate how much repair cost
will be reflected.

2.2.5 IICL – 6

As a trade association, Institute of International Container Lessors (IICL) mainly looks for
safeguarding lessors’ interests in the industry. The institute is active in fields like educational,
technological, safety, environment, governmental, regulatory, customs and tax. IICL – 6 publications are
container inspection and repair criterias published by IICL.

IICL – 6 is the sixth edition of the widely known criteria and it is implemented on August 1 2016.
IICL – 6 is the highest quality repair criteria in the industry. This criteria is the most strict and prepared
by the world’s leading lessors which explains the strictness of the criteria. IICL – 6 is a widely – used
criteria at on-hire and off-hires. The operators and lessors generally accept to use CIC during interchanges to define and measure the damages, although the lessors use IICL – 6 for the repair procedures. The main purpose of the standard is reducing operating and repair costs especially for the lessors. The Figure 6. compares UCIRC, CIC and IICL – 6 criterias’ differences. Although IICL – 5 and CIC updated, the figure is a good representation of different preferences of the container lessees and lessors. The figure only shows criteria that differ.

Figure 6. A Comparison of CIC, UCIRC and IICL – 5 on Dry Van Inspection Criterias [15]

![Figure 6. A Comparison of CIC, UCIRC and IICL – 5 on Dry Van Inspection Criterias](source: CIC Standards (2011))

### 3 CONCLUSION

The need for cost effective operations and the difference of preferences are the main reasons of the different types of inspection and repair criterias. While some parties may prefer to use one type of criteria others may choose to use another. The benefits of having more than one type of criteria seems to be more advantageous. For a person looking for a storage a wind and water tight container would be enough. The container operators’ and shipping lines’ main consideration is to carry the cargo most cost effective way and safely enough from one location to another. While the lessors’ main consideration is receiving and delivering the containers with the least cost and highest possible quality. Nevertheless, these criterias can be applied in harmony with each other. The already proven advantages of these criterias by the leading companies shows the critical importance of them.
REFERENCES


