



Tonnage Measurement of Ships

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'Tonnage' broadly is a measure of a ship's size which can be expressed in terms of either volume or weight.

The word 'ton' originates from the French 'tonneau', or English 'tun', which in the 13th century was a large wine cask of volume about 252 gallons, i.e. about 40 cubic feet, and weight about 2240 lbs. The term 'tonnage' originates from the levying of dues on ships, whether wine-carrying ships or not, the dues being based on the number of 'tuns' which a ship could accommodate. Up to the 15th century tonnage measurement was based on internal volume with the ship's size expressed in 'tuns', but from this time the procedure changed to a system with ships being assessed by the weight of cargo carried, and the standard unit of measurement became the ton of 2240 lbs.

By 1678 Thames shipbuilders expressed the deadweight of cargo carried in terms of the ship's dimensions derived by formula as follows:-

Deadweight of cargo carried was taken to be 3/5 of ship's displacement.

Displacement = Length x Breadth x Draught x Block Coefficient / 35

(where:

Draught was estimated to be 1/2 Breadth

Block Coefficient was averaged to be 0.62

35 was used being the number of cubic feet per ton of sea water)

therefore:

Deadweight = Length x Breadth^2 / 188 tons

In 1835 tonnage reverted to being a measure of internal capacity, and in 1854 the first British Merchant Shipping Act introduced the Moorsom System of tonnage, named after the Surveyor General for Tonnage, George Moorsom. This was based on the idea that the assessment of dues for services rendered to ships should be according to their potential earning capacity. In essence this meant that the internal volume available for carriage of cargo or passengers should be the measure of the potential earning capacity, and that tonnage should be proportional to this capacity. The Moorsom System included rules for measuring the internal volume available for cargo and passengers. Under the system two tonnages were required: first, to include the gross or entire space, except for exempted spaces, i.e. gross tonnage; second, to be that remaining after certain deductions were made, to be used as an index of the ship's earning capacity upon which duties would be based, i.e. net tonnage. In order to maintain tonnage values of the same order of magnitude as previously, it was found convenient to divide the volumes in cubic feet by 100, i.e. 1 ton = 100 cubic feet.

By the early 1900's the Moorsom System had formed the basis for most national tonnage measurements, although due to the varying interpretations and modifications made by individual countries considerable differences arose in the application of the system. Despite attempts to derive a uniform international interpretation of tonnage from 1925 onwards, it was not until 1969 that this was achieved in principle under the IMO International Convention on Tonnage Measurement of Ships.

The following are terms which have now become obsolete:-

'Gross Register Tonnage' (GRT) was a measure of the total internal capacity of the ship consisting of: under-deck volume excluding double-bottoms, volume of tween deck spaces, volume of superstructures, volume of deck-houses etc. Exemptions included: navigational spaces, galleys, stairways, light and air spaces. The total volume in cubic feet was divided by 100, i.e. 1 gross ton = 100 cubic feet. This was the Gross Tonnage entered in the ship's Register.

'Net Register Tonnage' (NRT) was a measure of the capacity available for the carriage of cargo and passengers. Deductions from GRT included: Master and crew accommodation, safety and storage spaces, water ballast tanks, allowance for propelling machinery. The resulting volume in cubic feet was divided by 100, i.e. 1 net ton = 100 cubic feet. This was the Net Tonnage entered in the ship's Register.

'Modified Tonnage' and 'Alternative Tonnage' were related to the gross and net tonnages where a ship was assigned greater than minimum freeboards under the Load Line Rules, i.e. where the second deck was treated as the freeboard deck and a 'Tonnage Mark' was placed on the ship's side at a tabulated distance below the level of the second deck. '

'Measurement or Shipping Ton' which was equivalent to 40 cubic feet.

Present

Under the IMO International Convention on Tonnage Measurement of Ships (1969), which initially entered into force on 18th July 1982 for new ships and which fully entered into force on 18th July 1994 for all ships except warships, ships of less than 24 metres in length and ships solely navigating: the Great Lakes of North America and River St. Lawrence; the Caspian Sea; the Plate, Parana and Uruguay Rivers, the following definitions apply:

'Gross Tonnage' means the measure of the overall size of a ship.

'Net Tonnage' means the measure of the useful capacity of a ship.

The method of determining the Gross and Net Tonnages is prescribed by formula as follows:-

Gross Tonnage (GT) = K1V

where, V = total volume of all enclosed spaces in cubic metres

K1 = 0.2 + 0.02 log10 V (or as tabulated in Appendix 2 of the Convention)

Net Tonnage (NT) = K2Vc(4d/3D)^2 + K3(N1+N2/10)

where, Vc = total volume of cargo spaces in cubic metres

K2 = 0.2 + 0.02 log10 Vc (or as tabulated in Appendix 2 of the Convention)

$K_3 = 1.25 (GT + 10,000)/10,000$

D = moulded depth amidships in metres

d = moulded draught amidships in metres (Summer Load Line draught)

N₁ = number of passengers in cabins with not more than 8 berths

N₂ = number of other passengers

N₁ + N₂ = total number of passengers the ship is permitted to carry as indicated in the ship's passenger certificate; when N₁ + N₂ is less than 13, N₁ and N₂ shall be taken as zero

GT = gross tonnage of the ship as determined above

The factor $(4d/3D)^2$ shall not be taken as greater than unity

The term $K_2 V_c (4d/3D)^2$ shall not be taken as less than 0.25 GT

NT shall not be taken as less than 0.30 GT

The '*Gross Tonnage*' and '*Net Tonnage*' figures as determined from the above formulae are to be those quoted on the ship's International Tonnage Certificate (1969).

It should be noted that the word '*tons*' is no longer to be applied since the gross and net tonnages are dimensionless, i.e. there are no physical units of tonnage. Hence the tonnage will be expressed as, e.g. the ship has '*Gross Tonnage of 12,345*' without the addition of any units. Also the word Register is to be omitted, hence the correct terminology is now '*Gross Tonnage (GT)*' and '*Net Tonnage (NT)*'.

There are also some other forms of tonnage in everyday use which are summarised as follows:-

'English or Long Ton' = 2240 lb (1016.05 kg).

'American or Short Ton' = 2000 lb (907.18 kg).

'Tonne or Metric Ton' = 1000 kg (2204.62 lb).

'Measurement or Shipping Ton' = 1 cubic metre.

'Bill of Lading or Freight Ton' = 1000 kg or 1 cubic metre of goods, whichever is the greater.

'Displacement Ton' is the unit for the total weight of a ship and her contents, equivalent to the weight of water displaced, under any particular condition of loading given in terms of the defined weight system, i.e. Metric or Long Tons. The maximum 'Displacement Tonnage' is that determined applicable under the International Load Line Regulations.

'Lightweight Ton' is the unit for the fixed weight of the empty as-built ship, equivalent to the weight of water displaced, given in terms of the defined weight system, i.e. Metric or Long Tons. The 'Lightweight Tonnage' is the weight commonly used as the basis for determining the scrap value of ships.

'Deadweight Ton' is the unit for the variable weight of the total contents of a ship under any particular condition of loading given in terms of the defined weight system, i.e. Metric or Long Tons, and is the difference between the Displacement Tons and the Lightweight Tons of the ship. The ship's 'Deadweight Tonnage' is typically quoted as being the maximum deadweight applicable under the International Load Line Regulations when floating at her Summer Load Line draught. The 'Deadweight Cargo Capacity Tonnage' is the Deadweight Tonnage less bunkers, water and constant weights.

'Panama Canal Tonnage' as of 1st October 1994 is comparable to the tonnage as determined by the IMO International Convention on Tonnage Measurement of Ships (1969). The tonnages stated on the Panama Canal Tonnage Certificate are therefore identical to those quoted on the International Tonnage Certificate (1969).

'Suez Canal Tonnage' is different from all other tonnage remaining based on the old Moorsom System of tonnage measurement, i.e. with gross and net tons being equivalent to 100 cubic feet or 2.83 cubic metres. There is apparently no immediate intention to change the basis of measurement under the Suez Canal Authority rules. The tonnages stated on the Suez Canal Special Tonnage Certificate are therefore different from those quoted on the International Tonnage Certificate (1969).

'Limitation Tonnage' is the tonnage that is used to determine the Limit of Liability of a shipowner (which includes the owner, charterer, manager or operator) or salvor (including any person for whose act, neglect or default the shipowner or salvor is responsible) and an insurer, in respect of loss of life or personal injury, or loss of or damage to property, occurring in direct connection with the operation of a ship or with salvage operations, including consequential losses. Under the IMO Convention on Limitation of Liability for Maritime Claims (1976) ("the LLMC Convention"), which entered into force on 1st December 1986, the 'Limitation Tonnage' is the ship's gross tonnage as determined by the IMO International Convention on Tonnage Measurement of Ships (1969) for those countries which have ratified the LLMC Convention. However, for those countries which have not ratified the LLMC Convention, the previous International Convention Relating to the Limitation of the Liability of Owners of Sea-Going Ships (Brussels, 10th October 1957), done under the auspices of the Diplomatic Conference on Maritime Law, still applies. Under this Convention the 'Limitation Tonnage' is the ship's net tonnage plus the allowance for propelling machinery that was deducted from the gross tonnage in order to obtain the net tonnage under the former Moorsom System of tonnage measurement.

(Click [here](#) for article on 1976 Limitation Convention)

The applications of Tonnage Measurement are many and varied and are used in the assessment of the following:-

Harbour Dues - which can be based on either Gross or Net Tonnage.

Pilotage Dues - which can be based on either Gross or Net Tonnage.

Light Dues - usually based on Net Tonnage.

Canal Dues - usually based on Net Tonnage.

Miscellaneous Fees - e.g. Agency, Towage, Dry Docking, P&I, Registration and Statutory Surveys.

Criterion for the application of IMO Conventions, e.g. SOLAS, MARPOL, STCW.

Basis for the formulation of shipping statistics.

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