

EIGHT ENGINE TERMS EVERY MARINE ENGINEER SHOULD KNOW

DINESH . T - B.TECH - IV

If you are a marine engineer or aspiring to be one, then it's obvious that you would eat, breath, and sleep marine engines. The study of marine engines forms an integral part of marine engineering syllabus. Needless to say, it is imperative for every marine engineer to know this important machine inside out.

A Marine engine is a complex machine, which requires years of experience and knowledge for understanding and handling the same. Moreover, there are several engineering terms which an engineer should know like the back of his hand.

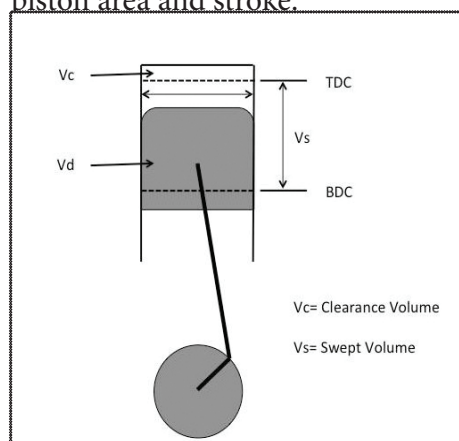
In this article, we have enumerated eight important definitions of marine engine terms which are extremely important and which will be used throughout the professional life of a marine engineer.



1. Swept Volume

Swept volume can be defined as the volume swept by the engine piston during one stroke.

Swept volume is also the product of piston area and stroke.



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2. Clearance Volume

Clearance volume can be defined

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as the volume that remains in the cylinder when the engine piston is in the top centre position.

Clearance volume can also be defined as the difference between the total cylinder volume and the swept volume. The space covered by the clearance volume also forms the combustion chamber.

3. Compression Ratio

The compression ratio can be defined as the value obtained by dividing the total cylinder volume by the clearance volume. Compression ratio is generally

between 12 and 18; however, it depends on the design of the engine. Compression ratio outside this ratio would either prevent the engine from starting or lead to other problems.

Marine engines with smaller cylinders will have higher compression ratio.

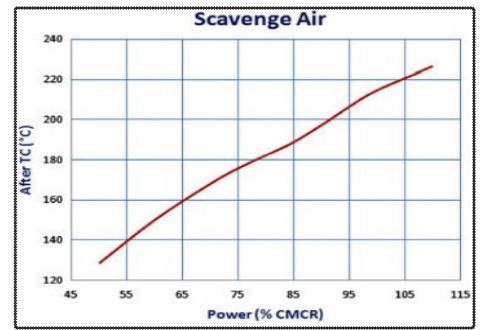
4. Volumetric efficiency

Volumetric efficiency can be defined as the ratio of the volume of air drawn into the cylinder to the swept volume.

In marine engines, the volumetric efficiency generally falls between 0.85-0.95.

5. Scavenge Efficiency

Scavenge efficiency can be defined as the ratio of the volume of air in the cylinder at the start of the compression to the volume swept by the piston from the top edge of the ports to the top of the strokes.



6. Air Charge Ratio

Air charge ratio can be defined as the ratio of the air contained in the cylinder at the start of the compression to the swept volume of the piston. It is also known as air mass ratio or air supply ratio.

In four-stroke marine engines, the value of air charge ratio will fall in the range of 0.85 to 4.

In two-stroke engines, the value will be in the range of 0.85 to 2.5

7. Natural aspiration

Natural aspiration is a term which mainly applies to four stroke engines and is defined as the process by which air charge is brought into the engine cylinder by only the downward movement of the piston without using other aids.

8. Super charging

Supercharging is a term used to indicate that the weight of the air supplied to the engine has been considerably increased for greater fuel usage and power production per stroke.

It is also noted that supercharged engines produce more power as compared to non-supercharged engines having the same stroke and speed.

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Saying that the global Covid-19 pandemic transformed our lives forever would be an understatement. Not only has it spurred the reign of digitization, but closer home to shipping, it has made companies across the world re-examine their supply chain management, logistics, and operational efficiency.

The entire shipping industry is now focusing on creating better, more sustainable shipping solutions, as evinced by the IMO's 2020 resolution – sustainable shipping for a sustainable planet.

It is interesting to speculate about the trends that will dominate this shift towards a more renewable tomorrow. Here's our take.

1. Focus on Decarbonization

Reduction of carbon emissions has been a long-term goal of the shipping industry, over the past decade. However, considering the rampant impact of climate change on global weather patterns we can expect to see a stronger push towards controlling carbon emissions in shipping.

As an industry, shipping is subject to the whims of nature. Natural disasters, storms, and cyclones can disrupt shipping operations for days at a time. In addition, as ships transport nearly 90% of the world trade and contribute to 3% of the total carbon emissions of the world,

it is high time for ocean freight to adopt more carbon-free measures.

The Marine Environment Protection Committee has drafted short-term amendments that aim to curb carbon emissions by 40% by 2030. If accepted, ships worldwide will be expected to modify their operations to comply with these global standards.

2. Large-scale Adoption of Smart Technology

Technology is central to the development of any industry and shipping is no exception. Over the past 10 years, the shipping industry has come a long way in terms of making processes Digi-savvy. The rapid spread of Covid-19 and all its variants is further fueling this transformation, making large-scale adoption of smart technology common.

Hence, smart ports are implementing an autonomous and digital approach to shipping, which helps ships and operators relay information, assess priorities, reduce traffic, and make strategic decisions on the fly, without the tedious paperwork.

The pandemic has led to the digitization of documents and operations which has transformed logistics processes for the better. For instance, The Digital Container Shipping Association announced plans for achieving full electronic bill of lading adoption, on the belief that an electronic bill of lading would benefit all parties in container shipping. Ocean Network Express, the world's sixth largest container line, recently became the latest

shipping line to offer fully electronic bills of lading to their customers.

Considering that the impact of Covid-19 will last for at least another two years, this trend is only expected to evolve in 2021.

3. Increased Use of Low-Sulphur Fuels

Sulfur emissions are one of the primary causes of maritime pollution and environmental degradation. IMO's 2020 sulfur regulation went into effect last year, making it mandatory for ships to reduce sulfur emissions by 0.5%. Furthermore, the Emission Trading System of the EU will seek reduction in greenhouse gas emissions to at least 55% by 2030.

In terms of shipping sustainability, the use of sulfur-based fuels is expected to decrease further, with companies looking for greener alternatives like very low sulfur fuel oil (VLSFO) and Liquefied Natural Gas (LNG).

In addition, shipping operators are alternatively installing scrubbers to reduce sulfur emissions and meet IMO 2020 standards, in case fuel replacement is not an option.

4. Setting up Shore-to-Ship Power

When docked at a port, ships have the option to either use self-generated power or connect to the port's electricity grid, depending on the location. Interestingly, an assessment by the Environmental Protection Agency shows that ship emissions can be reduced up to 98% if the ships connect to the shore's grid, especially if it is powered by renewable sources of energy.

With the ambitious emission control targets set by the IMO, 2021 can be the year when major world ports make a significant shift towards letting ships dock and connect to local electric supplies, to drive zero onsite emissions and import air quality of the port.

India is taking a step in this direction, by overhauling its ports policy for maritime trade. In an effort to increase port sustainability, the Ministry of Ports, Shipping, and Waterways has circulated a draft of the Indian Ports Bill 2020, which has provisions that will increase the safety, security, performance, and pollution control of Indian ports.

5. Alignment with Sustainable Development Goals

“The shipping industry is set to adopt sustainable development goals from 2021, making the 20s a decade of action and delivery, not only for the shipping industry but for the planet as a whole.”

-IMO Secretary-General Kitack Lim
Every aspect of the IMO's work connects to the 16 individual SDGs, marking a huge step forward for maritime sustainability.

This alignment with SDGs includes:

- providing a dependable and economic means of transport which will improve commerce and further prosperity,
- promoting sustainable fishing across coastal areas, improving air quality for people living in port cities,
- ensuring quality education and training for members of the maritime community,
- effective waste-disposal,
- development of sustainable infrastructure
- increase in port and coastal safety through risk management and global norms for security and efficiency of ports

- focus on carbon capture underwater topography and ocean fertilization to reduce the impact of climate change
- sustainable use of marine resources to halt land degradation, combat desertification, and reduce the loss of biodiversity
- increasing access to reliable, sustainable energy, and
- provision of equal growth opportunities without racial or gender biases

6. Embracing Diversity

Although the maritime industry has been a primarily male-dominated field, the introduction of sustainable goals is expected to offer more opportunities for women and people from ethnic minorities. Thus, the maritime community is cultivating an open-minded approach, with less emphasis on gender and more on qualification, capability, and performance.

To further a more inclusive industry and promote gender diversity in the maritime sector, Maritime SheEO and TOOL organized a virtual conference on the theme ‘Diversity and Sustainability: The Business Case’ and invited maritime speakers from across the world to discuss the progressive diversity scenario in the shipping industry. Additionally, the event also announced the launch of the Maritime SheEO Leadership Accelerator Programme, designed to provide training, mentoring, and networking opportunities for women in the maritime industry and equip them with the skills required to become confident decision makers who drive change.

This diversification of personnel will increase in the next few years, and create better and equal opportunities in the industry.

7. Building a Circular Economy

They say, what goes around, comes around. Nothing could be truer for the maritime industry, which has aimed towards creating a circular economy, based on the principles of ‘reduce, reuse, and recycle’, for years. However, it needs to go a step further and adopt the 12 principles of building a circular economy, as mentioned by Ichin Cheng in ‘Designing for the Circular Economy’.

These 12 steps include reduce, reuse, recycle, repair, refurbish, re-purpose, re-design in an eco-friendly manner, re-manufacture, the research and development of new materials, re-skilling, reverse supply chain management, and re-envisioning of the green revolution.

Creating a Sustainable Tomorrow for Shipping

While maritime sustainability has always been on the cards, 2021 will mark the shipping industry's serious foray into curbing emissions and adopting sustainable development measures. Hence, the trends mentioned above are some of the ways in which the maritime community is effecting an environmental, social, and economic change at the grass-root level, transforming everyday life for the seafarers.

Sustainable shipping is now the ultimate goal and we can see that all policy and regulation changes, diversification, digitization, and emission control measures are moving towards that unified objective.

What is your opinion about the maritime sustainability trends that will dominate 2021? Drop a comment to let us know!

Courtesy:shm safe sea ssafe shores

MARINE SAFETY IN INDIA POST 26/11: THE EVENT THAT INSPIRED SAFE SEAS, SAFE SHORES

AKASH MUKHERJEE - B.TECH - III

On 26th of November, 2008, India witnessed one of the most horrifying acts of terrorism, with 12 coordinated shootings, bombings, and hostage situations taking place across Mumbai. The attack targeted some of the most populous areas of the city and took hundreds of lives and injured many more, in a short span of four days.

The perpetrators of this inhumane attack had travelled across the sea and docked near Colaba, right in the heart of Mumbai. The ease with which they had crossed into international waters made 26/11 a wake-up call for India, emphasizing the need for stringent security measures along the coastline and marine routes.

Even as the government was reeling from the terror attack, numerous measures were implemented to enhance security in coastal areas and improve safety at sea. Several rescue and surveillance boats were commissioned, with stringent safety standards made mandatory for marine

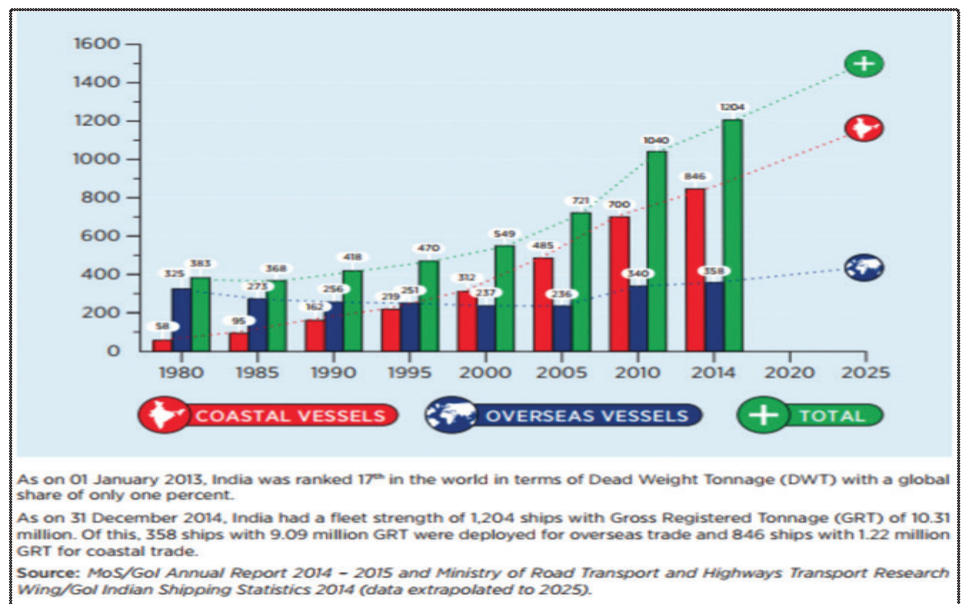


Fig.1 Statistics of Indian Trade using the sea as mode of transport

trade and commerce. An interception-based approach, rather than a simple patrol was considered, with the use of high-speed boats, which could travel at a speed of up to 40-45 knots, being promoted.

Unfortunately, safety regulations and legislation for oceans and seas have always been a reactive measure, after some calamitous attack has spurred action. Disasters such as the 9/11 attack on the World Trade Center and the 26/11 Mumbai bombings have been the catalysts for rapid deployment of safety measures to protect coastlines and naval routes.

India has 13 major ports and over 200 minor and

intermediate ports along its eastern and western coastlines and islands. More than 90% of Indian trade, by volume, is carried out via sea routes. Yet, the need still remains to view safety as a basic requirement, not a supplementary resource. The high density of trade along the sea lines of communication makes a safe environment crucial for the sustainable growth of the maritime industry.

14.2% of the Indian population lives in coastal areas. Repeated invasions via the sea, in 1993, 2008, the attempted hijacking of naval boats in 2014, all these incidents prove that vigilant protection from the traditional and non-traditional maritime

Indigenous Aircraft Carrier (IAC)
INS *Vikrant* is being built at Cochin Shipyard Limited (CSL), Kochi. Feasibility study for IAC-2 project is being progressed.

Naval Offshore Patrol Vessel (NOPV) Five ships are under construction at Pipavav Shipyard, Gujarat.

Project 15A Indigenously designed, these three ships follow-on to the *Delhi* class destroyers, with construction by Mazagon Docks Limited (MDL), Mumbai. The first ship, INS *Kolkata*, was commissioned in 2014.

Training Ship – Three ships are under construction at ABG Shipyard, Surat.

Project 15B Project 15B consists of four ships that follow-on to Project 15A. Under construction at MDL, the first ship INS *Visakhapatnam* was launched in 2015.

Survey Vessel – Order for six catamaran hull survey vessels has been placed on Alcock Ashdown, Bhavnagar. The first ship, INS *Makar*, is already in service.

Project 17A Seven stealth frigates follow-on to Project 17 (*Shivalik* class) under this project. Four ships will be constructed by MDL and three ships by Garden Reach Shipbuilders and Engineers (GRSE).

Landing Craft Utility (LCU) Eight LCUs are under construction at GRSE. Four of these have been launched.

Project 28 Four ASW stealth corvettes are being constructed by GRSE, Kolkata. Indigenously designed, the first ship, INS *Kamorta* was commissioned in 2014 and the fourth launched in 2015.

Fast Attack Craft (FAC) Four FACs are under construction at GRSE. Three of these have been launched.

Project 75 Six Scorpene submarines are under construction at MDL in collaboration with DCNS of France. The first submarine, INS *Kalvari*, was launched in 2015.

Immediate Support Vessel (ISV) Order for 14 ISVs was placed on SHM Shipcare, Mumbai, and 11 of these have been commissioned.

Project 75(I) This project envisages construction of six submarines in Indian shipyards with foreign collaboration.

Light Combat Aircraft (Navy) The first prototype (NPI) successfully completed ski-jump tests at the Shore-Based Test Facility (SBTF) at Goa in 2014. This aircraft would operate from the IAC.

threats like hostile action by opposing governments, maritime terrorism, piracy, and armed robbery is highly necessary.

The Current Scenario for Marine Safety

Some of India's core goals for marine safety have been to shape a favourable maritime environment for trade, protect on- and off-shore assets from coastal attacks, and develop and maintain an indigenous standing naval force to meet India's security requirements. To this end, the government has commissioned numerous mechanisms for increasing its interagency presence and patrolling and operative measures.

There has been a cosmic shift in perspective, with the Indian government pushing for indigenous resources more and more, over foreign help for maintaining its defences. The Make in India initiative is the product of the realization that India cannot and should not rely on international whims when it comes to building weapons and equipment for self-defence. Post the 2008 terror attack, 14 Immediate Support Vehicles were commissioned by the Indian navy from indigenous manufacturers, SHM Shipcare, to provide

Fig.2 Indigenous Projects on the Horizon



patrolling and interception services.

In fact, SHM Shipcare is one of the leading players catering to a provision of high-speed boats and safety equipment for the Indian Navy, since 2014. The company has come up with several innovative boat designs, such as ISV boats, for various applications such as surveillance, interception, recreation, rescue and emergency services, offshore operations, patrolling, and more. The 14 Immediate Support Vehicles supplied to the Indian Navy are designed to have speeds of up to 40 knots,

an endurance rating of 600 NM, and operations support for inland, coastal, and open seas. In addition, the company also provides extensive ship repair services across the major ports of India and in countries like Singapore, Dubai, and Malaysia.

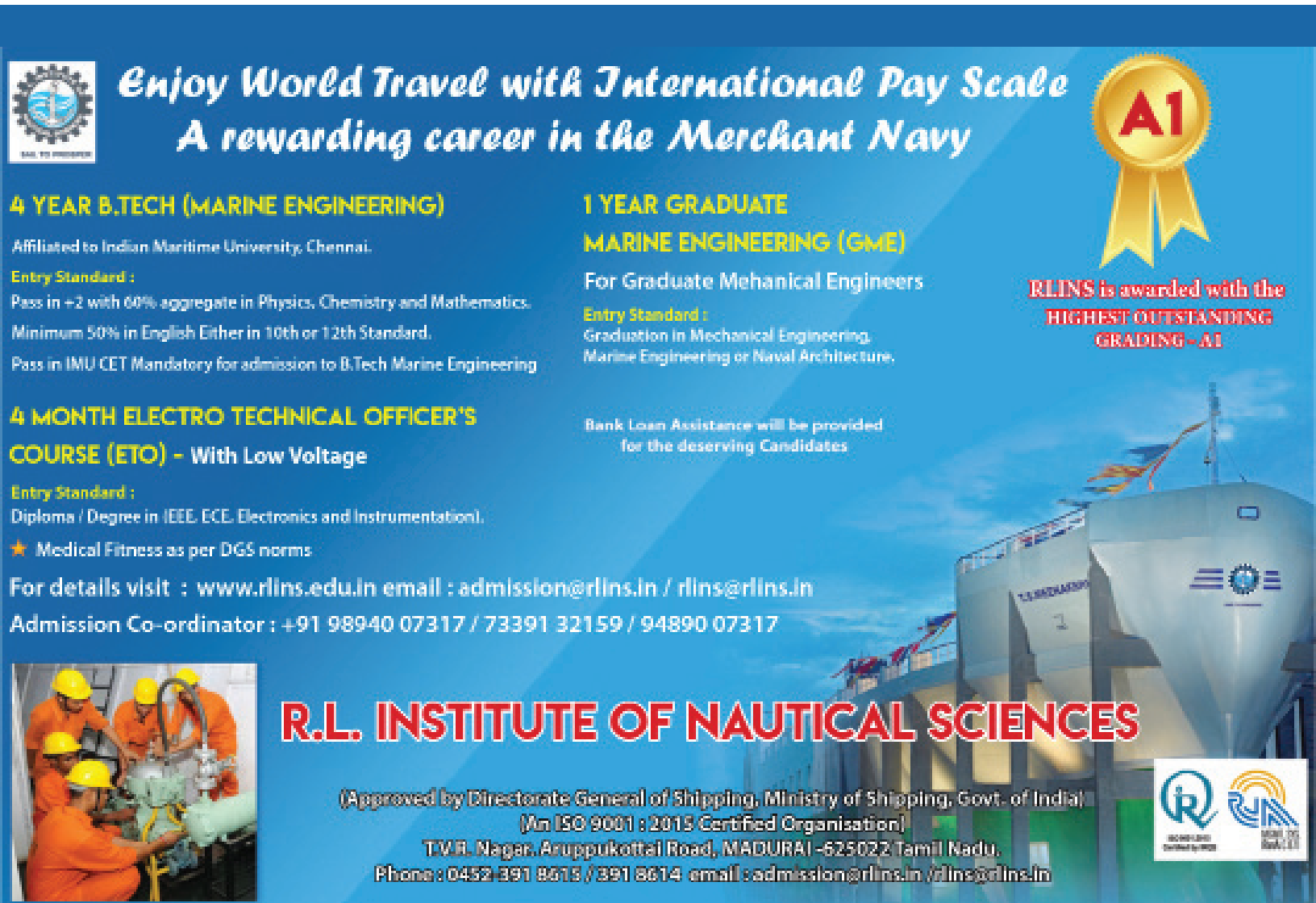
Conclusion

The events that shook the world had severe ramifications pertaining to national and international security measures. The chapter of 26/11 has taught us through harsh experience, about the importance of marine safety for peace. Not only have these events changed

the course of Indian history, but they have also played a crucial role in shaping naval policies for safe seas and safe shores.

India is a strong maritime force in the world, on account of its dynamic, geographically-strategic environment. However, there is a growing need to reduce international dependence for fulfilling our safety requirements. The Indian Navy and the Coast Guard, in conjunction with indigenous ship manufacturers in India, like SHM Shipcare, are hence, taking immense efforts to make the vision of safe seas and safe shores a reality for the nation.

Courtesy:safe seas,safe shores



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