# MAZAGON DOCK SHIPBUILDERS LIMITED

# DEPARTMENT OF INDIGENISATION

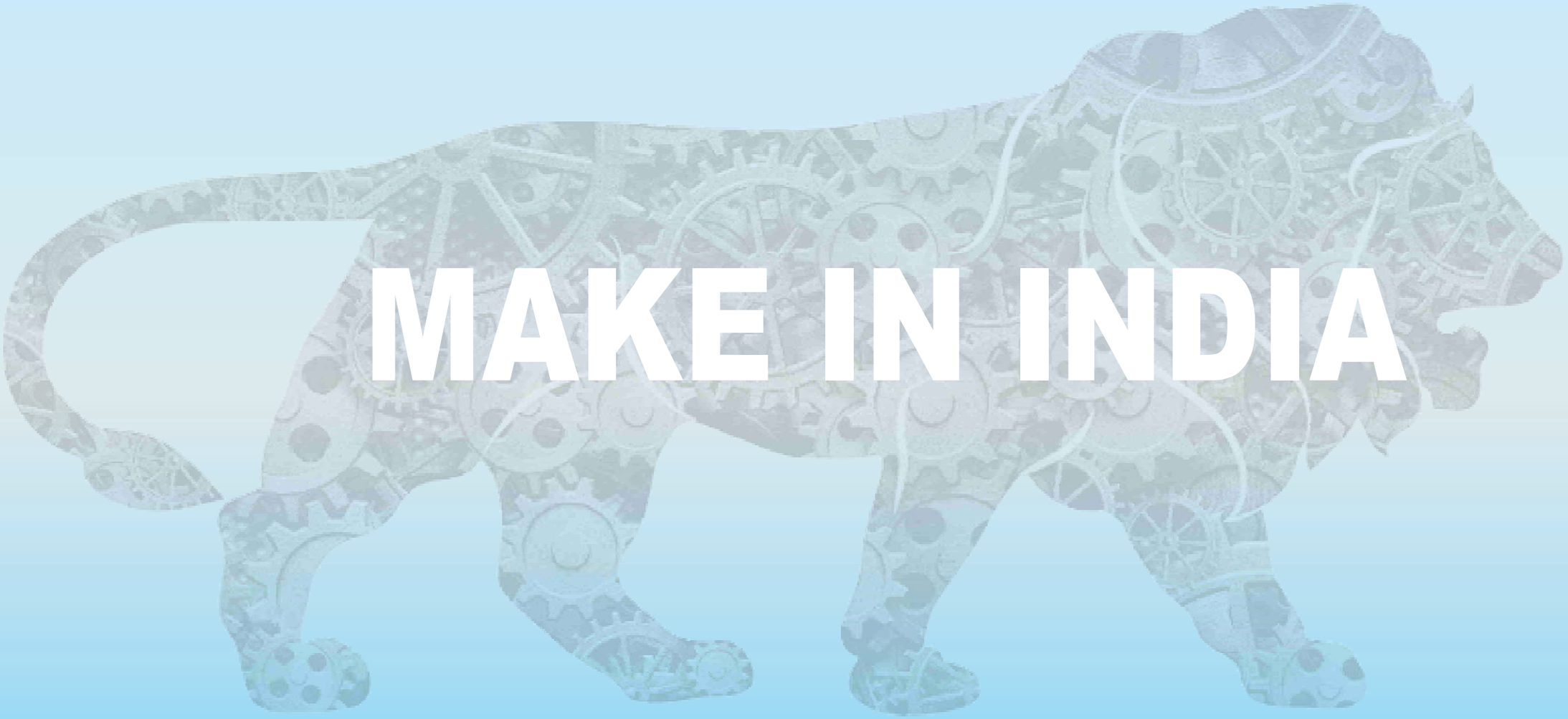
TRANSFORMING


INTO A REALITY

# MAKE IN INDIA - IN MDL

## Developing Eco System for Naval Platforms


## Encouraging, Empowering and Leveraging the Potential of Indian Industry to take on Indigenisation


MAKE IN INDIA

# CONTENTS


MAKE IN INDIA
मेक इन इंडिया
MAKE IN INDIA
PM launches "Make in India"

# PREFACE

Hon'ble Prime Minister, Shri Narendra Modi gave a Clarion call from the ramparts of the Red Fort on 15 Aug 2014, where he said "I would like to call people of the world to ' Come, Make in India. I want to tell the global Companies that we have skill, talent and discipline. Paper to plastic, automobiles to agriculture products, come, make in India, from satellite to submarine, come, make in India. We have the capabilities. Come here and manufacture in India. Sell the products anywhere in the world but manufacture here… we have the power, come I am inviting you".

The launch of 'Make-in-India' initiative is intended to provide the requisite thrust and create a conducive environment for the Indian industry to take on indigenous production of defence equipment and create a vibrant industrial base to achieve self-reliance in defence.

Increased indigenisation content in strategically significant projects like warship and submarine building, through the complex process of transfer of technology, convergence of knowledge, ideas and competence is the need of the hour.

While indigenous construction of warships & submarine in itself is an indigenisation success story, MDL is committed to further increase the indigenisation content to higher levels in its successive built platforms by indigenising the items/equipment that we continue to import thus reducing the dependency on foreign firms.

Propelling the indigenisation activities in MDL is the Department of Indigenisation, which has been formed to transform the 'Make-in-India' policy a reality in true letter and spirit.

# MAZAGON DOCK SHIPBUILDERS LIMITED

## SHIPBUILDERS TO THE NATION

Mazagon Dock Shipbuilders Limited is a leading Defence Shipyard in the country and is committed to continuously enhance the indigenous content of the ships, submarines and other vessels being built to ensure that the 'Make-in-India' mission launched by the Government of India is a success story in letter and spirit.

# MESSAGE

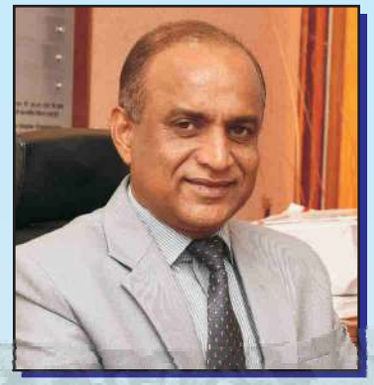
## Vice Admiral Narayan Prasad (IN Retd),
### Chairman & Managing Director

Mazagon Dock Shipbuilders Limited is a leading Defence Shipyard in the country engaged in producing world class state of the art Warships and Submarines. “Make in India” in MDL dates back to 1960, when it was acquired by the Government with a strategic national objective of Indigenous Shipbuilding. MDL, since then, has built and delivered a large number of frontline Warships, Submarines and various auxiliary commercial vessels. The first indigenously built frontline warship, INS Nilgiri was built by MDL and delivered to the Indian Navy in the year 1972. Since then, MDL has been continuously striving to enhance the indigenous content in the successive deliveries of the ships and submarines.

I, am proud that MDL has taken a lead in propagating the Hon’ble Prime Minister’s clarion call of “Make-in- India” by setting up a dedicated Department of Indigenisation to provide focused impetus to further enhance indigenisation content in the platforms that are being built at MDL.

Department of Indigenisation has made a very good beginning in development of the ecosystem for the Naval Platforms by encouraging, empowering and leveraging the potential of Indian industry to take on indigenisation of systems, sub-systems and equipment/items that continue to get imported till date. This initiative by MDL has not only resulted in achieving greater self reliance but has also helped in transforming the “Make in India” vision into reality. It gives me great pleasure to release this book depicting successful indigenisation of various equipment/items by MDL with the help of Indian industries, Naval authorities, DRDO organizations and various Trials and Testing agencies.

# MESSAGE



**CMDE. T V THOMAS, NM (Retd.),**
**Director (Corporate Planning & Personnel)**

Setting up of a dedicated Department of Indigenisation is a great initiative by MDL in the quest of self-reliance by indigenisation of defence equipment in India. It gives me great pleasure that the newly set up Department of Indigenisation, at MDL, has been able to develop and encourage the Indian industry to indigeniously develop systems, sub-systems and equipment/items to obviate the dependence on foreign suppliers.

This was made possible by successfully steering the indigenisation program with all the stakeholders viz., Indian Navy, Indian industries, Academia and the Testing & Trial agencies. Towards this the Department of Indigenisation has played a key role by necessary handholding and providing all the necessary support to the Indian industry taking on indigenisation during the entire developmental process thus ensuring that the systems, sub-systems and equipment / items get developed indigenously as per the specified requirements.

I am confident that this initiative taken by MDL will encourage more and more Indian industries to come forward and participate in the indigenisation program and be part of defence supply chain to achieve self reliance in defence.

# MDL - HISTORY AT A GLANCE

Inception
1774

Public
Limited
Company
1934

GOI took
over as PSU
1960

DEFENCE

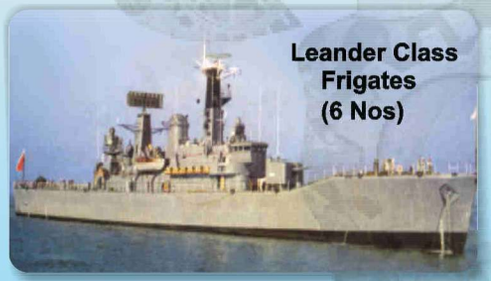
ENERGY

COMMERCIAL

- Total Vessels 865
- Warships / Para Military 45
- Submarines 03
- Off Shore Platforms 68
- Jack Up Rigs 02
- Vessels Foreign Clients 243
- Vessels Indian Owners 504

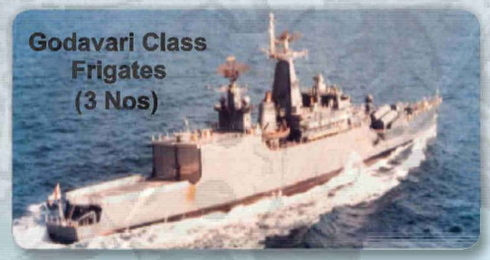
- Lead Shipyard for major surface combatants (Destroyers & Frigates)
- Only Shipyard capable of building conventional submarines
- Only Shipyard possessing two independent Submarine assembly & launch lines

# WARSHIPS & SUBMARINES DELIVERED TO THE INDIAN NAVY




1972-1982







1983-1993





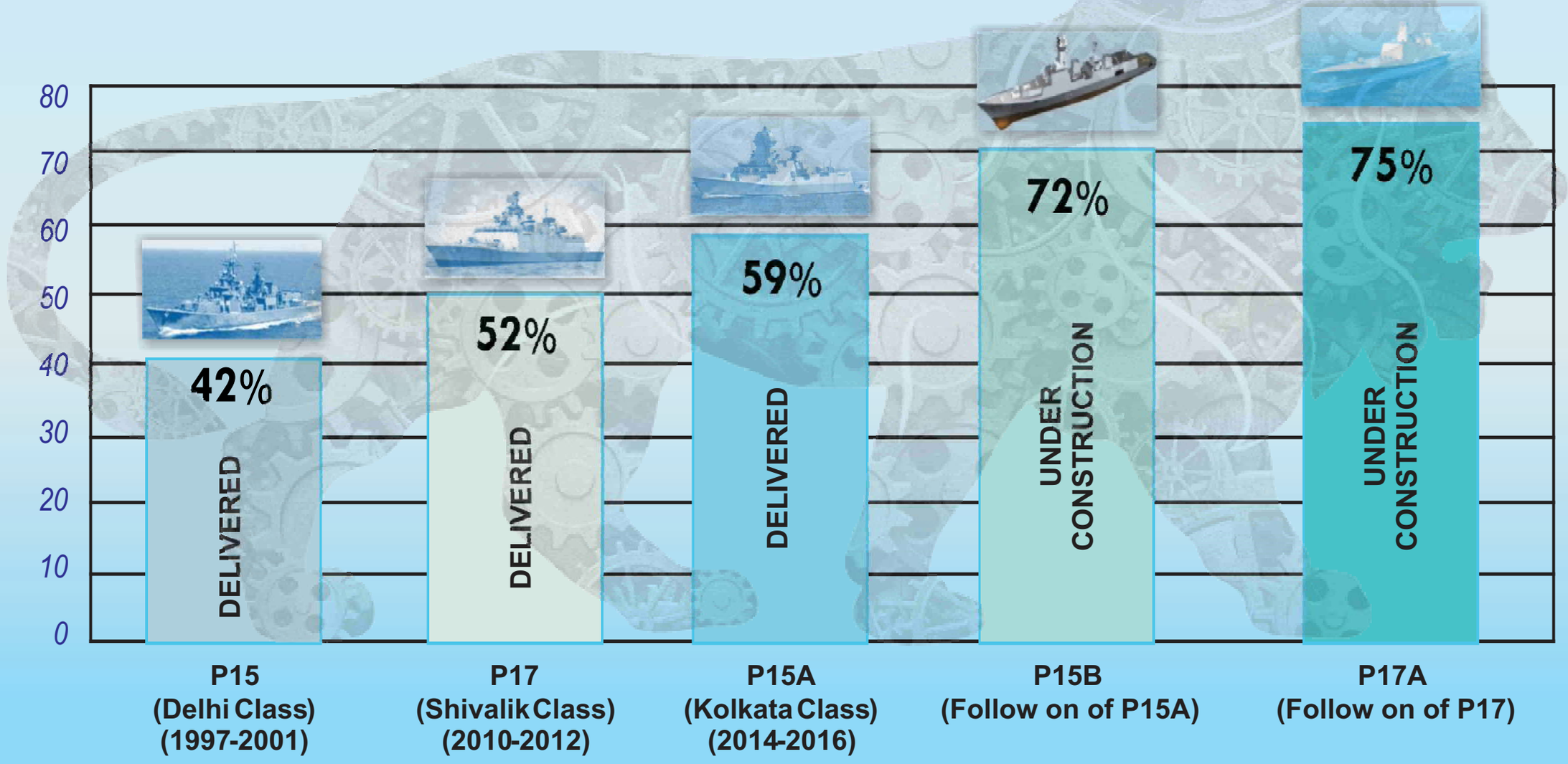
1994-2004



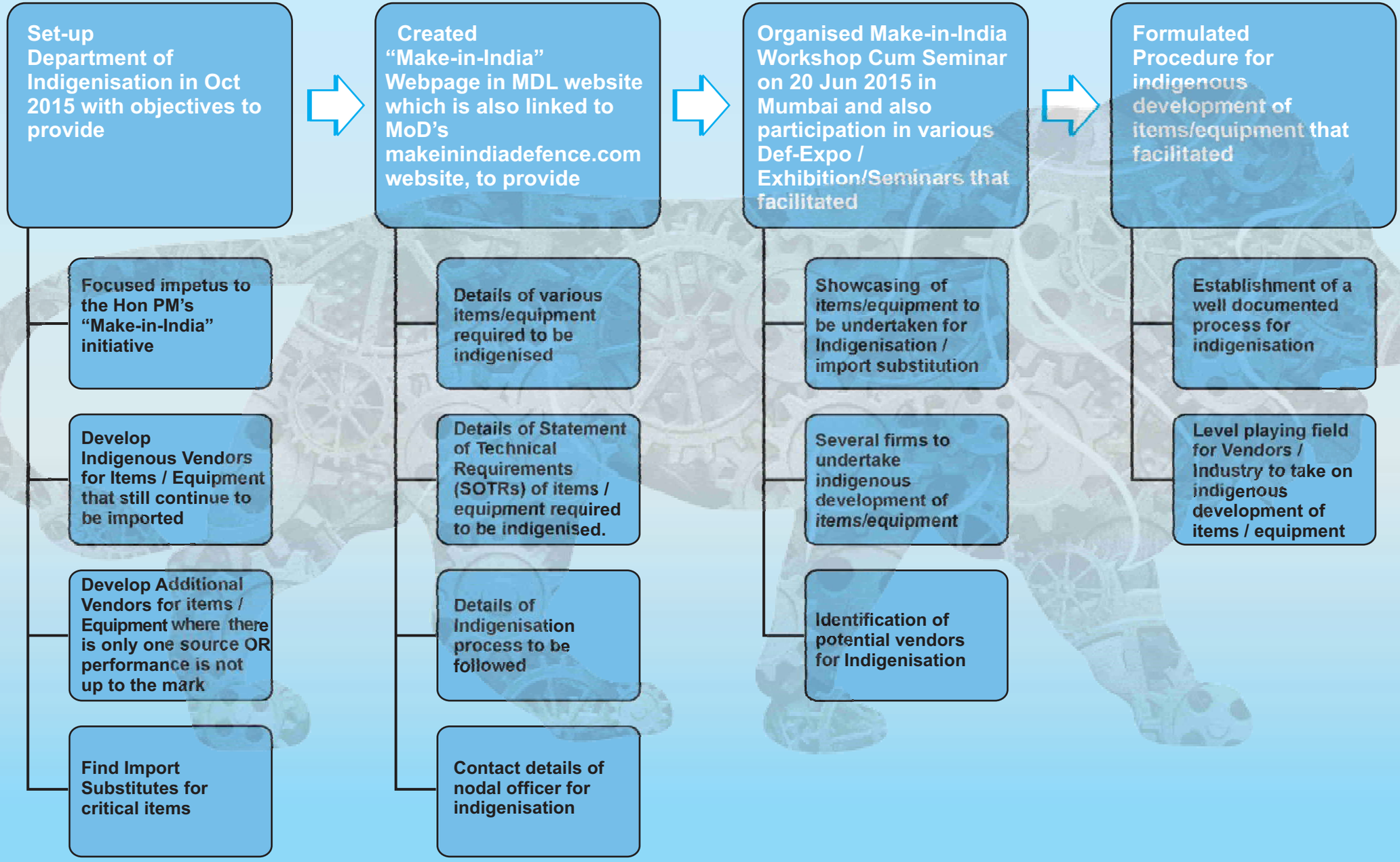

2005-2020

# ‘MAKE IN INDIA’ IN MDL

**Make in India in MDL dates back to 1960, when under a strategic national objective of indigenous ship building , indigenous construction of first front line warship, INS Nilgiri was undertaken. Since then MDL has been continuously striving to enhance the indigenous content in the successive deliveries of ships and submarines. MDL’s stellar efforts and commitment towards inigenisation are evident from the fact that the percentage of indigensation content in the ships built by MDL has been steadily increasing.**



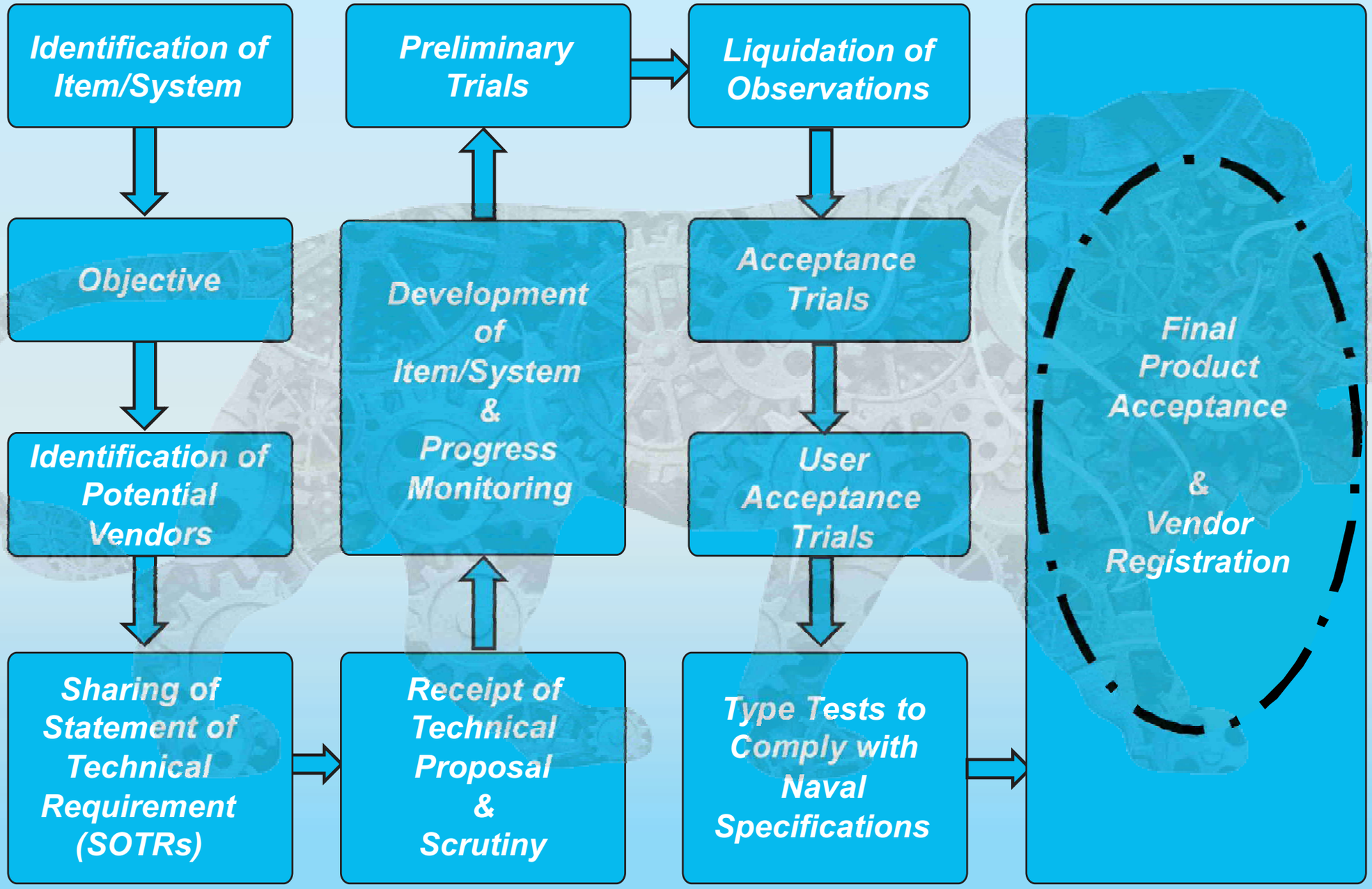
# INITIATIVES - POST LAUNCH OF 'MAKE-IN-INDIA'



# MAKE IN INDIA WEBPAGE - ITEMS TO BE INDIGENISED

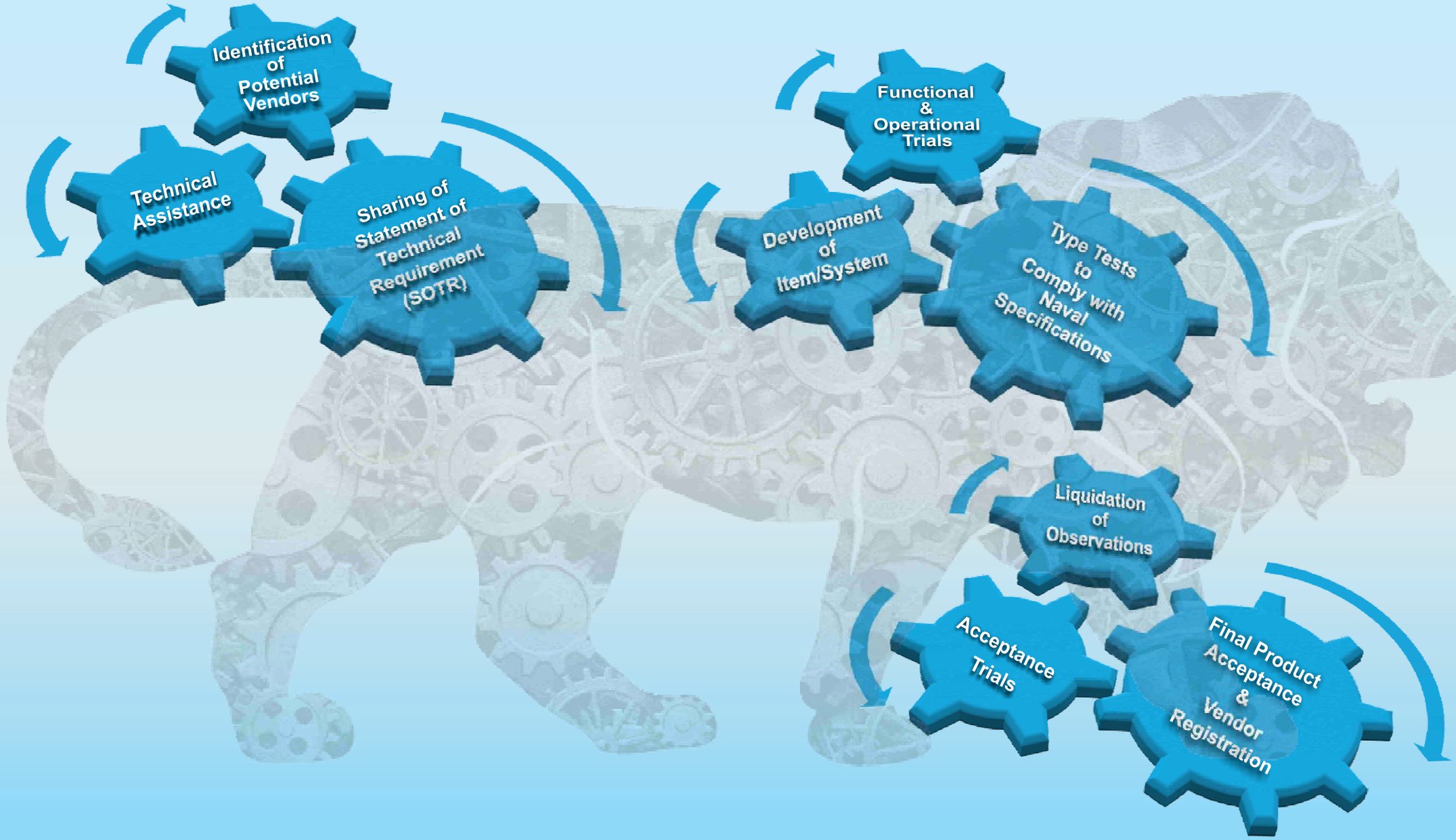
| SNo | Item Description | Approx Qty Required in Next 10 Years | Present Source of Supply | Photographs | Details of SOTRs |
|---|---|---|---|---|---|
| 1. | MCT Glands / Frames with insert blocks and accessories | 1) MCT Frames- 6000 Nos.<br>2) Insert Modules- 200000 Nos.<br>3) Wedge Seal, Stay Plate Sealant tools etc.- 70000 Nos. | 1) M/s. BST Mumbai<br>2) M/s. Roxtec, Sweden<br>3) M/s. Hawkes Transit Systems, Spain<br>4) M/s Consilium, Sweden |  | Click here for Details |
| 39. | Coaxial Cables Shielded & Non Shielded | 50 & 75 Ohms 800 Metres per Boat | 1) Nexan, France |  | Click here for Details |

# INDIGENISATION PROCESS FLOW CHART



# SELECTION OF VENDORS FOR INDIGENISATION

# HANDHOLDING – KEY FOR SUCCESSFUL INDIGENISATION



# MAJOR EQUIPMENT / ITEMS INDIGENISED


## SONAR DOME

- Start Date– Jun 2014
- End Date– Mar 2016
- Earlier Source of Import - M/s Atlas, Germany
- Now Indigenised By - M/s Kineco, Goa
- Savings in FE for ongoing projects – INR 200 CR

## SICADS

- Start Date– Oct 2014
- End Date– Apr 2016
- Earlier Source of Import - M/s Smiths, UK
- Now Indigenised By - M/s L&T-SEC, Bengaluru
- Savings in FE for ongoing projects – INR 17 CR

## RC-VALVE (IPMS)

- Start Date– Jan 2016
- End Date – Apr 2016
- Earlier Source of Import - M/s Thompson, UK
- Now Indigenised By - M/s DelVal, Pune
- Savings in FE for ongoing projects – INR 15 CR

## MCT GLANDS

- Start Date – Mar 2016
- End Date – Sep 2016
- Earlier Source of Import - M/s Roxtec, Sweden
- Now Indigenised By - M/s Wallmax, Faridabad
- Savings in FE for ongoing projects – INR 16 CR

## MAIN BATTERIES FOR SUBMARINE

- Start Date – Mar 2016
- End Date – Nov 2016
- Earlier Source of Import - M/s Hagen Batteries, Germany
- Now Indigenised By - M/s Exide Industries, Mumbai
- Savings in FE for ongoing projects – INR 24 CR

# MAJOR EQUIPMENT / ITEMS INDIGENISED

### BRIDGE WINDOW GLASS

- Start Date– May-2016
- End Date– Dec 2016
- Earlier Source of Import - M/s Saint Gobain, Spain
- Now Indigenised By - M/s Jeet & Jeet Glass,Jaipur
- Savings in FE for ongoing projects – INR 22 CR

### RC-VALVE (HVAC)

- Start Date – Aug 2016
- End Date – Jan 2017
- Earlier Source of Import - M/s Axima, France
- Now Indigenised By - M/s Chamunda Valves, Ahmedabad
- Savings in FE for ongoing projects – INR 32 CR

### HELO LANDING GRID

- Start Date – Aug 2016
- End Date – Jun 2017
- Earlier Source of Import - M/s DCNS, France
- Now Indigenised By - M/s Seetha Technologies, Chennai
- Savings in FE for ongoing projects – INR 14.2 CR

### HONEYCOMB FILTER

- Start Date – Apr 2017
- End Date – Sep 2017
- Earlier Source of Import - M/s Axima, France
- Now being Indigenised By - M/s Accurate, Pune
- Savings in FE for ongoing projects – INR 1.08 CR


### ASBESTOS FREE GASKET

- Project Start– Jul 2017
- End Date– Mar 2018
- Earlier Source of Import - M/s DCNS, France
- Now Indigenised By - M/s James Walker-Imarco, Mumbai
- Savings in FE for ongoing projects – INR 0.26 CR

# MAJOR EQUIPMENT / ITEMS INDIGENISED

### PRS

- Project Start– Jan 2016
- End Date– Jul 2018
- Earlier Source of Import - M/s Dynamic Control, UK
- Now Indigenised By - M/s India Futuristic Pvt., Ltd, Goa
- Savings in FE for ongoing projects – INR 26 CR

### NBC FILTER

- Start Date – Apr 2017
- End Date – Oct 2018
- Earlier Source of Import - M/s Axima, France
- Now being Indigenised By - M/s Nikhtish Enterprises, Pune
- Savings in FE for ongoing projects – INR 17 CR


### HIGH TEMP GASKET

- Project Start– Jul 2018
- End Date– Nov 2018
- Earlier Source of Import - M/s Naval Group, France
- Now Indigenised By - M/s Pilot Gaskets & Engineers, Mumbai
- Savings in FE for ongoing projects – INR 2.05 CR

### FIRE DAMPERS

- Project Start– Jul 2018
- End Date– Nov 2018
- Earlier Source of Import - M/s Axima, France
- Now Indigenised By - M/s SAF Refrigeration Engineering, Navi Mumbai
- Savings in FE for ongoing projects – INR 2 CR

### CONTROL DAMPERS

- Project Start– Jul 2018
- End Date– Nov 2018
- Earlier Source of Import - M/s Axima, France
- Now Indigenised By - M/s SAF Refrigeration Engineering, Navi Mumbai
- Savings in FE for ongoing projects – INR 2 CR

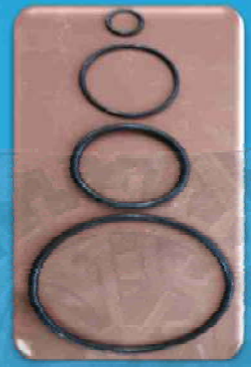
# MAJOR EQUIPMENT / ITEMS INDIGENISED

## SMOKE DAMPERS

- Project Start– Jul 2018
- End Date – Nov 2018
- Earlier Source of Import - M/s Axima, France
- Now Indigenised By - M/s SAF Refrigeration Engineering, Navi Mumbai
- Savings in FE for ongoing projects – INR 2 CR

## FLAME PROOF GAUZE

- Project Start– Jul 2018
- End Date– Nov 2018
- Earlier Source of Import - M/s Axima, France
- Now Indigenised By - M/s SAF Refrigeration Engineering, Navi Mumbai
- Savings in FE for ongoing projects – INR 4CR



## O-RING

- Project Start– Sep 2017
- End Date– Dec 2018
- Earlier Source of Import - M/s Naval Group, France
- Now Indigenised By - M/s James Walker-Imarco, Mumbai
- Savings in FE for ongoing projects – INR 0.42 CR

## E GLASS CLOTH

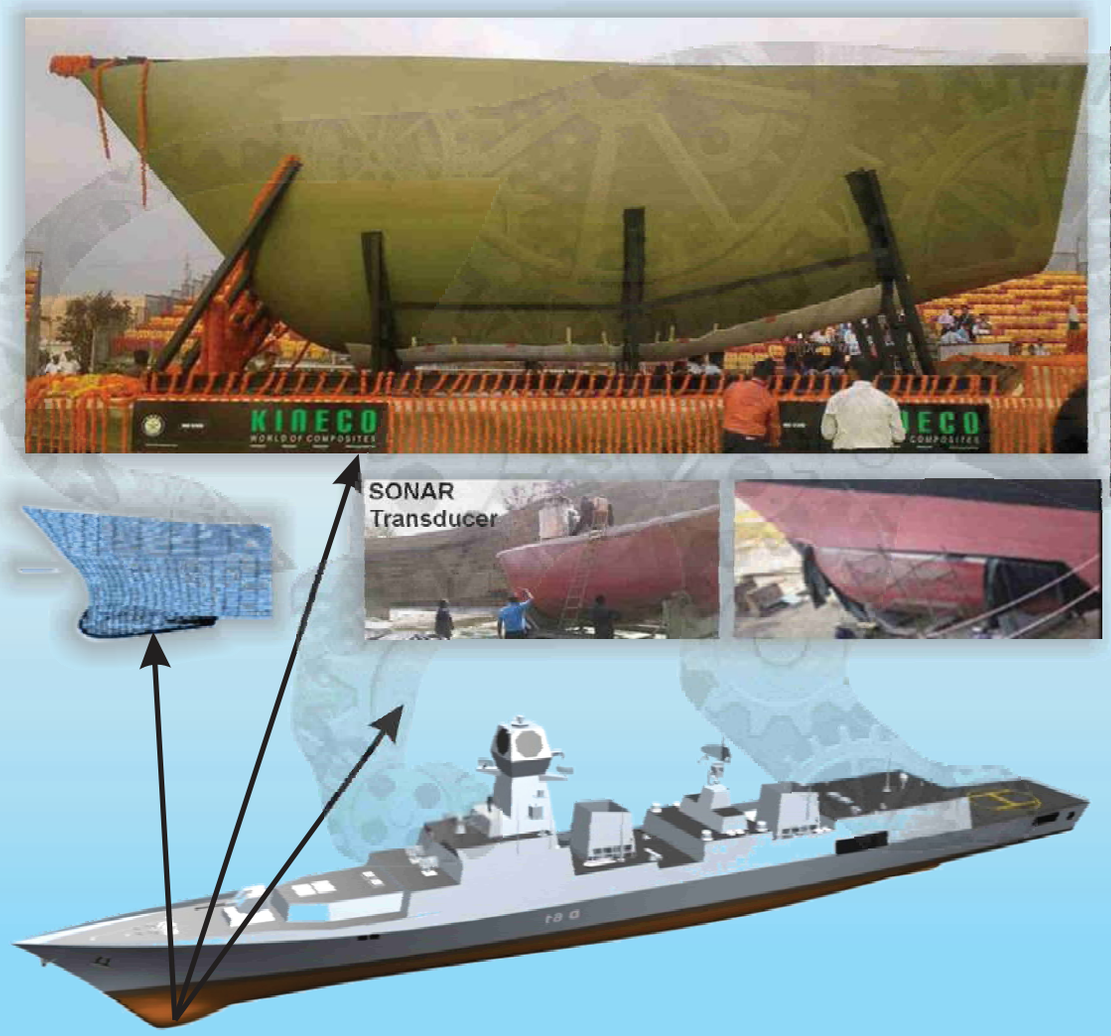
- Project Start– Oct 2018
- End Date– Dec 2018
- Earlier Source of Import - M/s Naval Group, France
- Now Indigenised By - M/s James Walker-Imarco, Mumbai
- Savings in FE for ongoing projects – INR 0.12 CR

## BATTERY LOADING TROLLEY

- Start Date – Jul 2017
- End Date – Dec 2018
- Earlier Source of Import - M/s MESURSA, Spain
- Now being Indigenised By - M/s SEC, Hyderabad
- Savings in FE for ongoing projects – INR 1.93 CR

# INDIGENISATION OF SONAR DOME

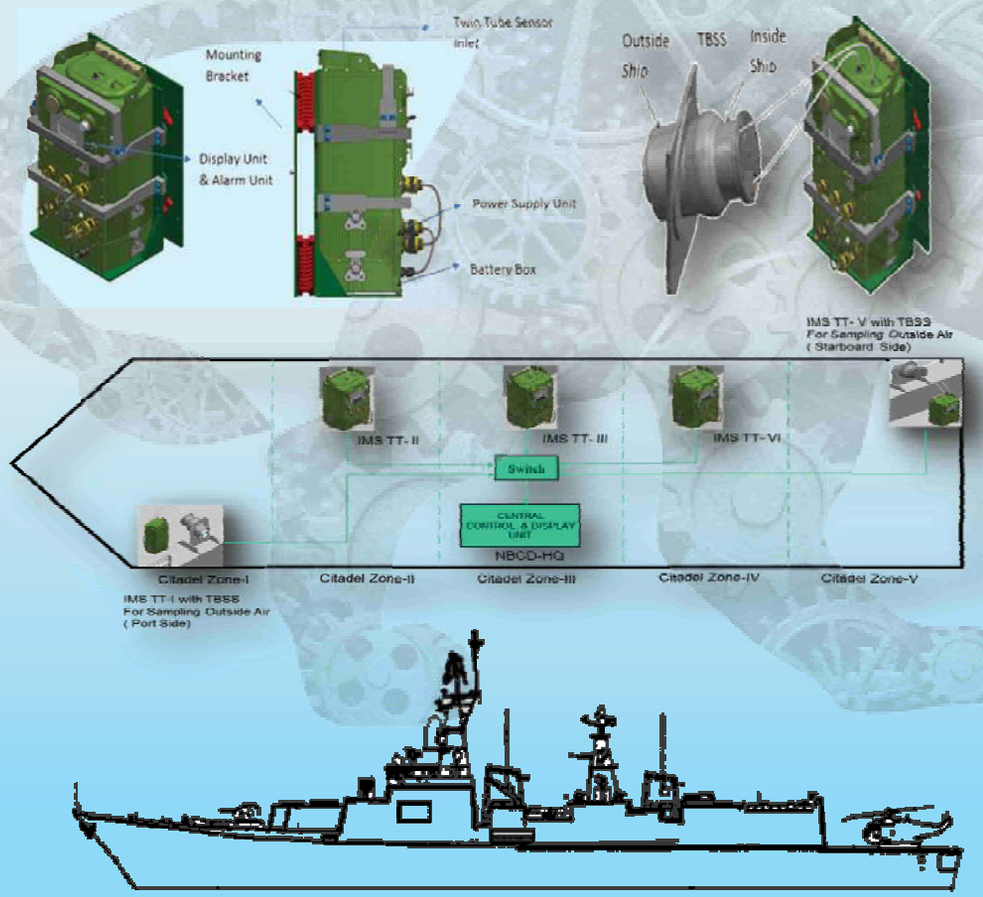
Sonar Dome is a GRP composite structure that houses SONAR Transducer and is mounted at the forward of the ship. It acts, both as a protection and acoustic window for the ship's SONAR. The Bow mounted SONAR Dome, fitted on IN Ships, have so far been imported from UK & Germany. MDL has now successfully indigenised the SONAR Dome with assistance from a consortium of M/s R&D Engineers, Pune, NOPL, Kochi and M/s Kineco, Goa (Production Partner)




| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Dimensions | Length: 10.5 m |
| | | Width: 2.7 m |
| | | Height:3.2 m |
| | | Enclosed Volume: 60 m3 |
| | | Weight: 4500 Kgs. |
| 2. | Operating Conditions | Designed to withstand loads occurring with speeds up to 32 Knots. |

# INDIGENISATION OF SICADS
## (Ship Installed Chemical Agent Detection System)

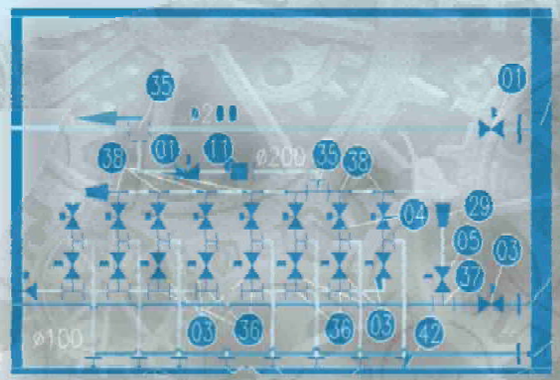
SICADS is a state of the art detection system fitted onboard Indian Naval Ships for rapid and continuous real time identification and measurement of chemical warfare agents present in the environment both outside and within ship and provide necessary display & alarm indications. The SICADS, fitted on IN Ships, have so far been imported from US, UK & Germany, the only three countries who have the capabilities to develop such system. MDL has now successfully indigenised the SICADS through M/s L&T-SEC, Bengaluru, with assistance from M/s DRDE, Gwalior. With this India now becomes the fourth country in the world to have capabilities to develop such complex item.

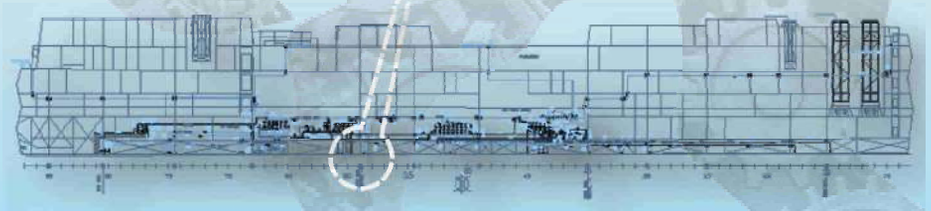


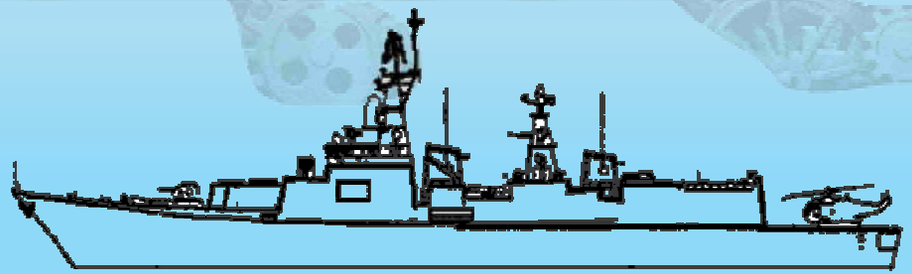

| Specifications | | | |
|---|---|---|---|
| **Size** | Detector 260 x 215 x 186 mm | | |
| | Battery Box 99 x 215 x 186 mm | | |
| **Weight** | Detector only – 5.5 Kg, with battery – 7 Kg | | |
| **Power** | 7.4V Li Polymer rechargeable batteries | | |
| **Agents detected** | Agent Type | Chemical | Detectable Min Concentration Level ($mg/m^3$) |
| | Nerve | Sarine (GB) | 0.05 |
| | Nerve | Tabun (GA) | 0.05 |
| | Nerve | Soman (GD) | 0.05 |
| | Nerve | Cyclo Sarine (GF) | 0.05 |
| | Nerve | Vx | 0.05 |
| | Blister | Sulphur Mustard (HD) | 0.5 |
| | Blister | Lewisite | 0.5 |
| | Blood | Hydrogen Cyanide (HCN) | 20.0 |
| | Chocking | Phosgene | 20.0 |
| **Alarm** | Audio / visual and provision of remote alarm | | |

# INDIGENISATION OF REMOTE CONTROLLED VALVES (IPMS)

RC-Valves on-board warships form a critical part of Integrated Platform Management System (IPMS). The RC-Valves used onboard are mainly of two types viz., Butterfly Valve type, sizes varying from 80 to 250 NB and Ball Valve type, sizes varying from 10 to 65 NB, both operated remotely by electrical actuators. On board warships these valves are used to handle Fresh water, Sea Water, Chilled water & Fuel Oil with pressures up to 10 bars. Till date this item has been imported M/s Thomposn, UK. MDL has now successfully indigenised this item through DelVal, Pune.



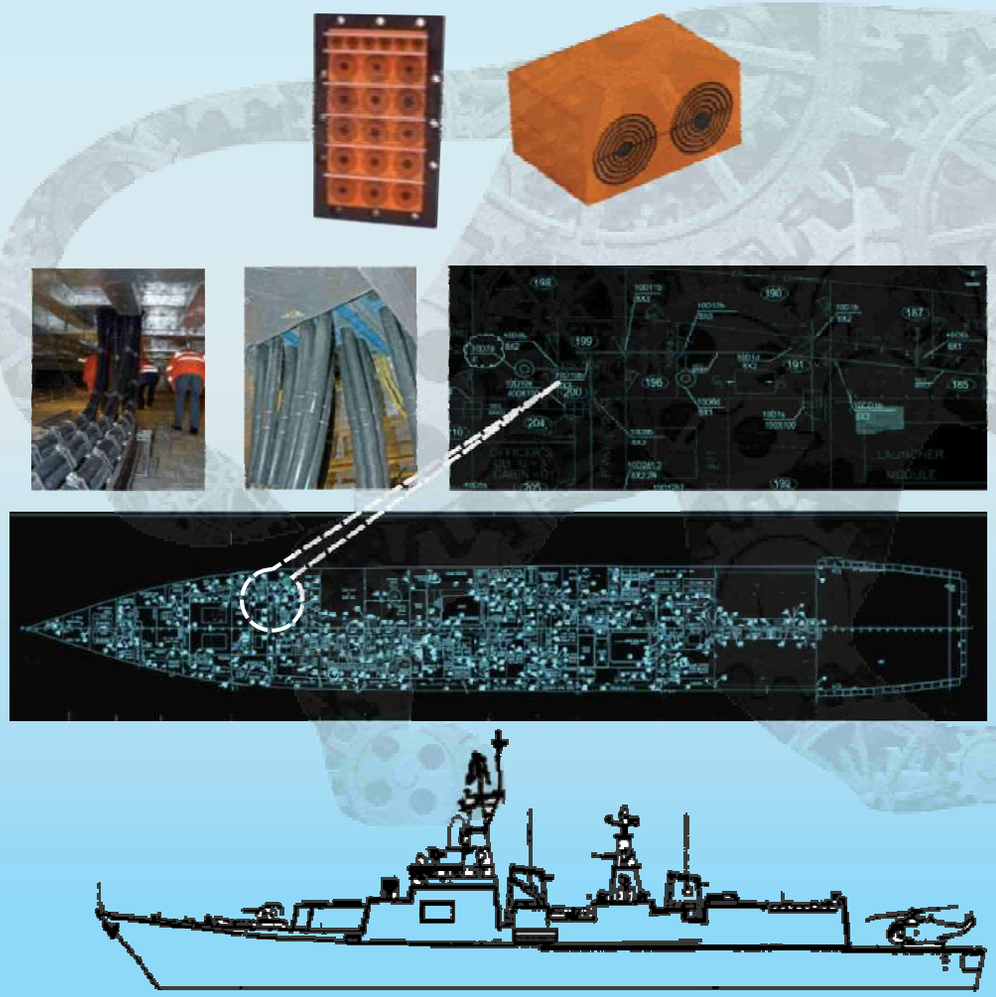




| SNo | Parameter | Specifications/Standards |
|---|---|---|
| 1. | Butterfly Valves Size | 80 to 250 NB |
| 2. | Ball Valves Size | 10 to 65 NB |
| 3. | Design Code | NES 375/International Standards |
| 4. | Fluids handled | Fresh water, Sea Water, Chilled water & Fuel Oil |
| 5. | Operating Pressure | 10 Bar |
| 6. | Fluid Velocity | 3-4 Meters / Sec |
| 7. | Material | NAB / GM |
| 8. | Operating Voltage (Motor Operated) | 380/415 V, 3 Phase, 50Hz. |
| 9. | Operating Voltage (Electro Pneumatic - Spring Return) | 230V, 1 Phase, 50Hz. |
| 10. | Noise Requirement | As per type 2 of the “MIL-STD-740-2” |

# INDIGENISATION OF MULTI CABLE TRANSIT GLANDS (MCT-GLANDS)

MCT Glands on-board warships are used in bulk quantities for sealing cable entries through bulkheads/deck heads. There are typically about 950 numbers of MCT Glands of various sizes fitted onboard a warship. The MCT Glands consist of a metallic frame made out of ST37 Grade steel with inside cable modules of various sizes made out of halogen free material that allow cables of various sizes to pass through them and provide gas tight integrity up to 0.3 bar and water tight integrity up to 4 bar. Till date this item has been imported from M/s Roxtec, Sweden. MDL has now successfully indigenised this item through M/s Wallmax, Faridabad.

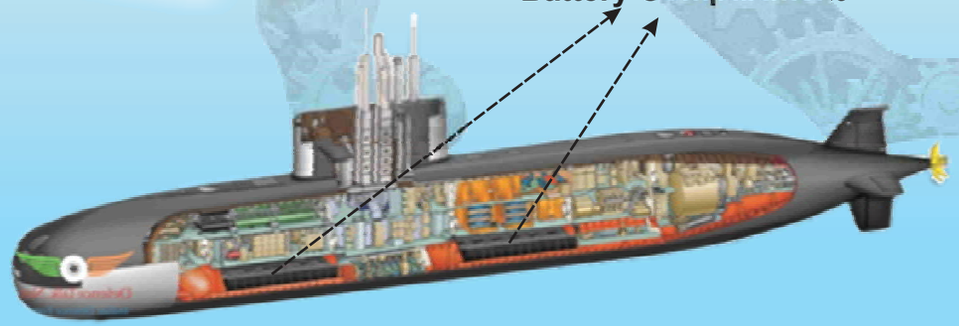


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | MCT Frame Size | 4X1 & 8x1 |
| 2. | Insert Module Type 1 | Core suitable for cable dia. from 5 mm to 14 mm, Block size 20. |
| 3. | Insert Module Type 2 | Core suitable for cable dia. from 14 mm to 23 mm, Block size 30. |
| 4. | Insert Module Type 3 | Core suitable for cable dia. from 22 mm to 34 mm, Block size 40. |
| 5. | Insert Module Type 4 | Core suitable for cable dia. from 34 mm to 51 mm, Block size 60. |
| 6. | Material | EPDM or equivalent with Low Smoke Index. |
| 7. | Water and Gas Tight Integrity | Up to 2 Bar |

# INDIGENISATION OF MAIN BATTERIES
## (Scorpene Submarine)

Main Batteries are critical items on board Submarines. For the first three Scorpene Submarines these batteries have been imported from Hagen Batteries, Germany. MDL's indigenization efforts, along with Indian Navy, has reached a successful stage resulting in order placement by MDL for the fourth submarine on Exide Industries, Mumbai. Indigenisation of Main Submarine Batteries from fourth submarine onwards has resulted in considerable savings in FE to the exchequer.

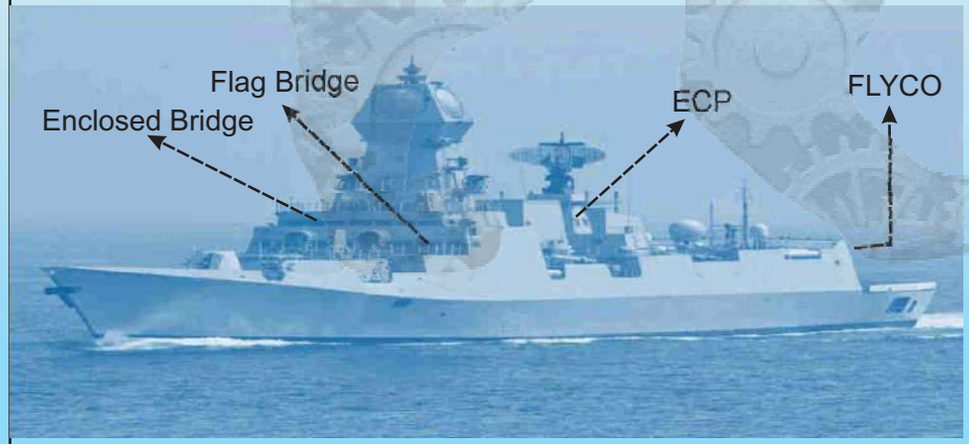

Battery Compartment



| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Number of Batteries | 360 nos. arranged in two sets of 180 nos. each |
| 2. | Battery Type | 36 PS 13 I, Lead Acid |
| 3. | Short Circuit Current | Typically < 60 KA |
| 4. | Wh-efficiency | > 0.85 |
| 5. | Dimensions | Length : 1325 mm<br>Width : 360 mm<br>Height : 500 mm |
| 6. | Weight, filled | Max.: 700 Kgs. |

# INDIGENISATION OF BRIDGE WINDOW GLASS

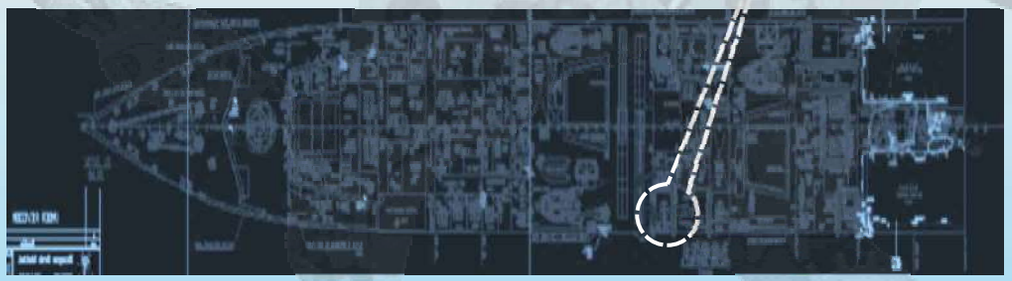
Bridge Window Glasses fitted onboard Warships are special blast proof and radar opaque glasses and form an important part of Enclosed Bridge, Flag Bridge, CEP and FLYCO compartments. Installation of Bridge Window Glasses with suitable wipers is one of the critical requirement as it helps in providing clear view for Ships Navigation and Helo Operations. Approximately 32 Bridge Window Glasses of various sizes, with max size being 1790x700 mm and thickness 19 to 25 mm are required per ship. Till date Bridge Window Glasses fitted onboard Ships have been imported from M/s Saint Gobain, Spain. MDL has now successfully indigenised this item through M/s Jeet & Jeet Glass, Jaipur with 100% indigenisation content.

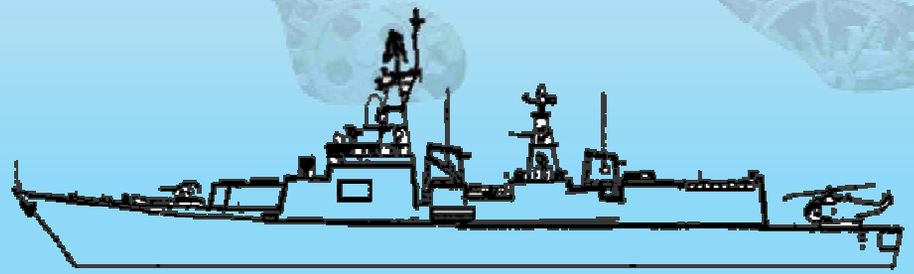



| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Optical Transparency | >75% |
| 2. | Blast Pressure | Up to 2.1 Bar |
| 3. | Noise Attenuation | 45dB at 500Hz |
| 4. | Resistance to Shock and Vibration | MIL-STD-167-1A & MIL-STD-901D |
| 5. | Electromagnetic Shielding | 40dB between 1 GHz and 40GHz in accordance with DefStan 59-41/MIL-STD 461E and MIL STD 285. |
| 6. | Vibration Test | JSS 55555 |

# INDIGENISATION OF REMOTE CONTROLLED VALVES (HVAC System)

Remote Controlled Vales on-board warships form a critical part of HVAC System. These electrically operated valves are used to handle low pressure air in air-conditioning ducts with pressures up to 1.5 bars. Approximately 130 to 150 numbers of RC-Valves mainly of Butterfly type, sizes varying from 100 to 600 NB are required per ship. Till date this item has been imported from M/s Axima, France. MDL has now successfully indigenised this item through M/s Chamunda Valves, Ahmedabad.

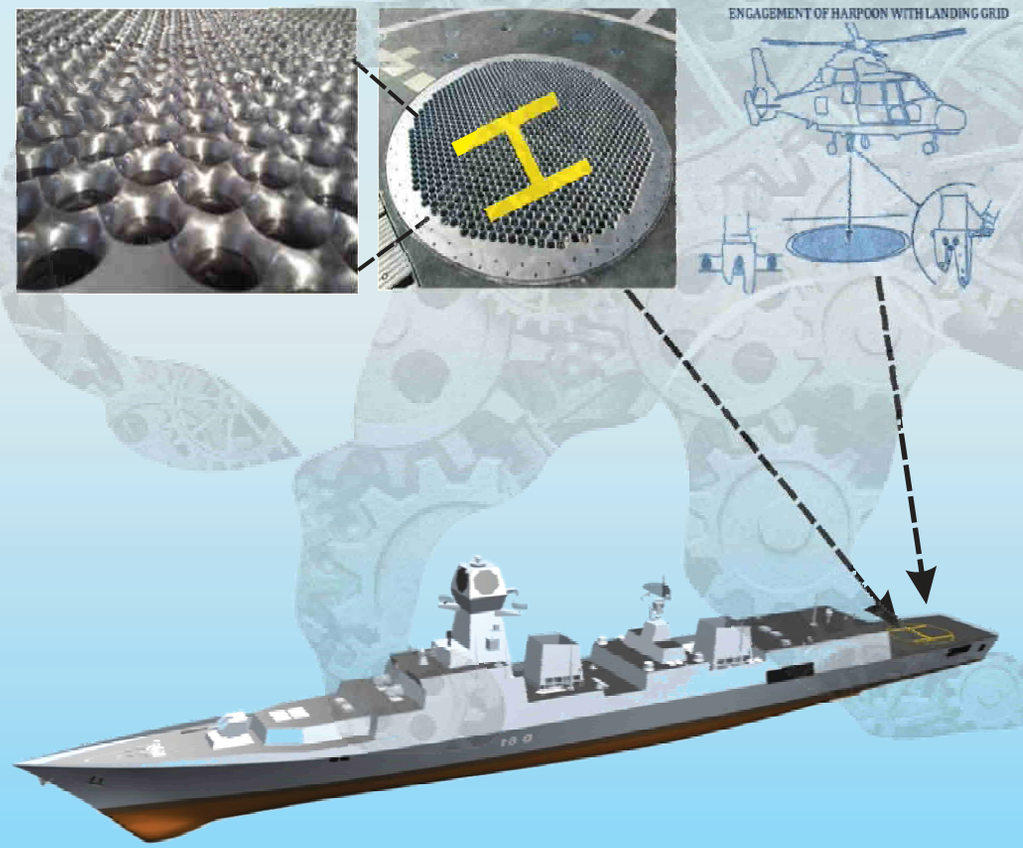





| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Butterfly Valves Sizes | 100 to 600 NB |
| 2. | Design Code | NES 375/International Standards |
| 3. | Fluids handled | Low Pressure Air |
| 4. | Operating Pressure | 1.5 Bar |
| 5. | Fluid Velocity | 8-10 Meters / Sec |
| 6. | Material | Aluminium |
| 7. | Operating Voltage (Motor Operated) | 380/415 V, 3 Phase, 50Hz. |
| 8. | Operating Voltage (Electro Pneumatic - Spring Return) | 230V, 1 Phase, 50Hz. |
| 9. | Noise Requirement | As per type 2 of the “MIL-STD-740-2” |

# INDIGENISATION OF HELO LANDING GRID

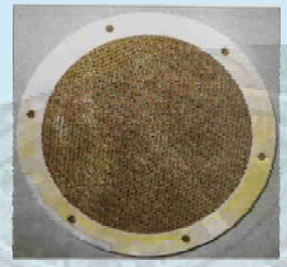
The HELO LANDING GRID is a critical item, that allows helicopters fitted with a harpoon to land or take off from a helideck in fully safe conditions, without assistance even in rough seas and bad weather. It is installed on the flight deck of the warship and is made of Special High Tensile stainless steel plate that has number of specially shaped machined holes, forming a honeycomb pattern. The harpoon engages over one of the wall between any two holes of the top stainless steel plate. It comes in several versions suitable for heaviest helicopters. Till date this item has been imported from M/s DCNS, France. MDL has now successfully indigenised this item through M/s Seetha Technologies, Chennai.

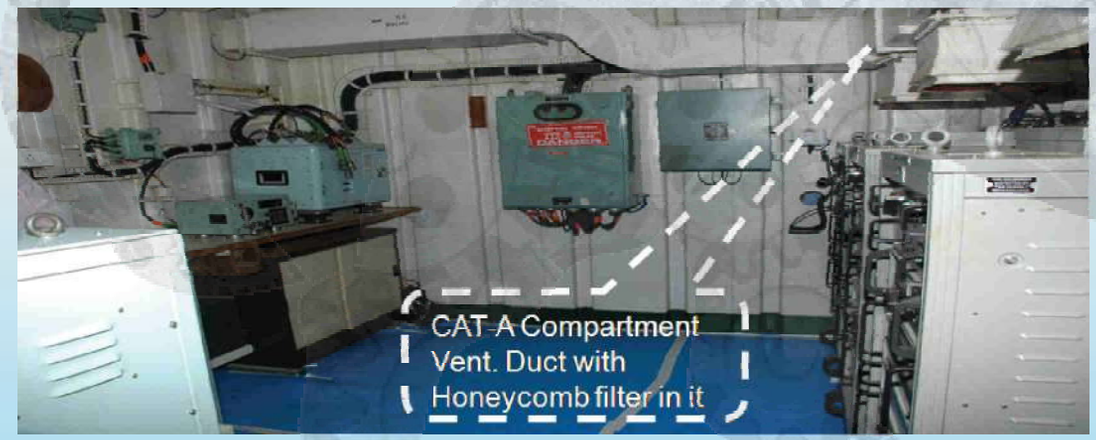



| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type/Model | 11 VP-22 DF |
| 2. | Max. Diameter | 2750 mm |
| 3. | Usable Diameter | 2500 mm |
| 4. | Height of the Landing Grid | 200 mm |
| 5. | Designed Vertical Pull | 11,000Kg |
| 6. | Designed Downward Push | 21,500 Kg |
| 7. | Total weight | 2550 Kg |
| 8. | Conforming Standard | NATO – STANAG 1276 – H.O.S - Ed. 2. - 2014. |

# INDIGENISATION OF HONEYCOMB FILTERS

Honeycomb filters form an integral part of HVAC system onboard warships. These filters are mounted in the ventilation ducts to attenuate electromagnetic waves passing in to the compartment, especially CAT-A Compartments that houses critical communication and weapons control systems. These filters till date were imported as an integral part of HVAC system from M/s Axima, France. MDL has now successfully indigenised this item through M/s Accurate Industrial Control Pvt, Ltd., Pune.

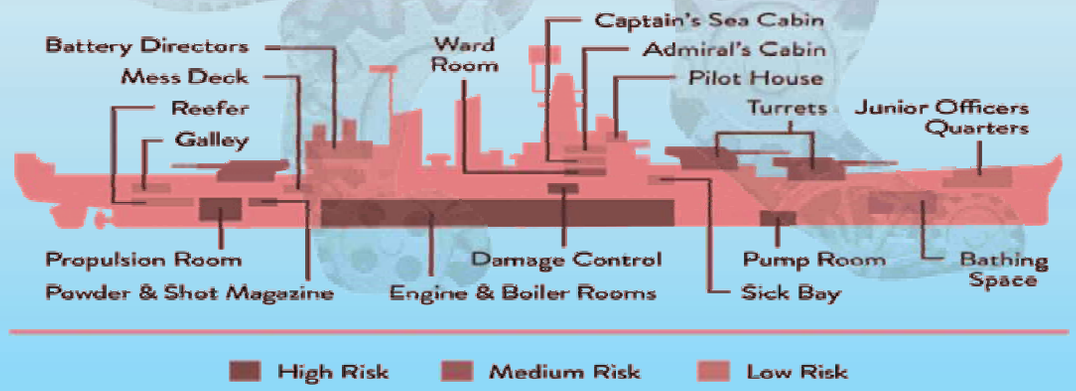





| S No | Parameter | Specifications/Standards |
|---|---|---|
| 1. | Size | 1) 150 x 150 NB<br>2) 150 NB Dia |
| 2. | Material | Aluminium |
| 2. | Air Flow | 8 m/sec |
| 3. | EMI/EMC Standard | MIL 461E |
| 4. | Shielding Effectiveness | As per IEEE Std 299-2006 |
| 5. | Frequency Range | 14 kHz to 18 GHz |

# INDIGENISATION OF ASBESTOS FREE FIBRE GASKETS

Due to the health hazards, the use of Asbestos Gaskets is banned onboard ships and submarines. Hence it was imperative to develop a material that is heat resistant, has the insulation properties as that of asbestos and is affordable. Asbestos free gaskets are widely used onboard submarines and ships for a variety of applications such as insulation, packing/sealing material for pipe flanges in various systems. Till date these gaskets were being imported from DCNS, France. MDL has now successfully indigenised this item through M/s James Walker-Imarco, Mumbai.

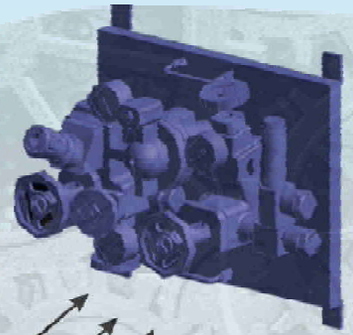


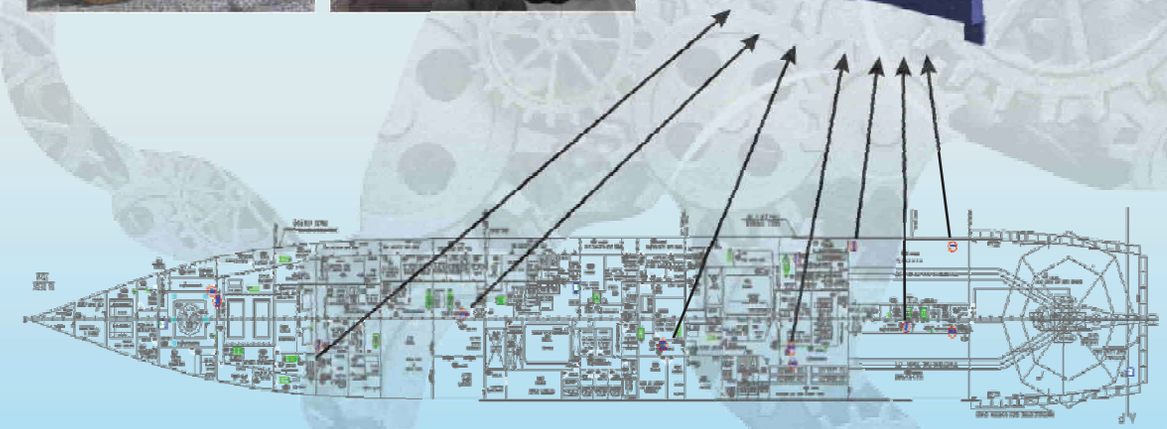

Levels of Risk for Asbestos Exposure on Naval Ships
(Where Asbestos Free Gaskets can be used)

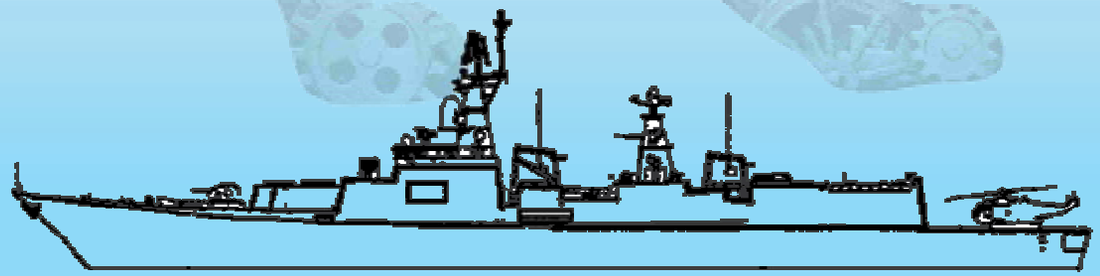
| S No | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type | Thickness<br>1) 2 mm<br>2) 3 mm |
| 2. | Material | Asbestos free fiber sheet<br>As per STF 33-07-02/001E D |
| 3. | Dimensional Tolerance | Inner Dia: +/- 0.5 mm<br>Outer Dia: +/- 0.5 mm<br>Thickness : +/- 0.2 mm |
| 4. | Conforming Standard | NF EN 10204 edition 01/2005 |

# INDIGENISATION OF PRESSURE REDUCING STATION (PRS)

The PRS is a critical item, used for reducing high pressure to the various low pressure ranges required for starting/controlling of various machineries onboard ship. Till date this item has been imported from M/s Dynamic Control, UK. MDL has now successfully indigenised this item through M/s India Futuristic Marine Pvt. Ltd., Goa.



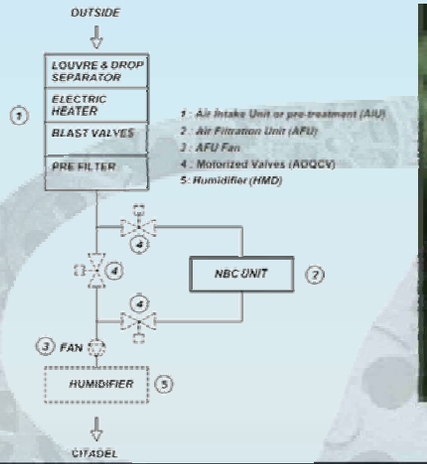


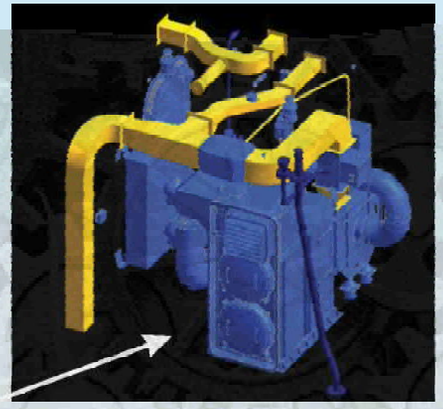


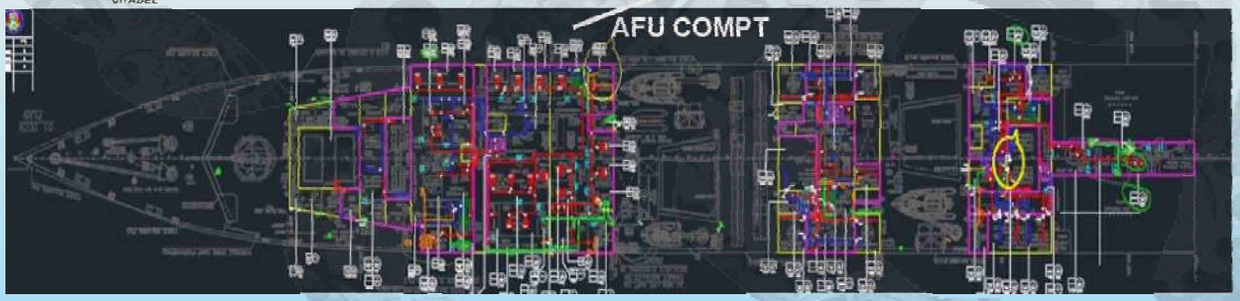
| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type/Construction | Compact Forged Monoblock |
| 2. | Filtration size / Air Quality | 20 Microns / 95% dry Air |
| 3. | Noise / Vibration | MIL-STD-740-2 / MIL-STD-167A |
| 4. | Input Range | 140 to 180 Bar |
| 5. | Output Range | 19 Bar @ 35 lpm |
| 6. | Shock Grade | IN Shock Grade-A |

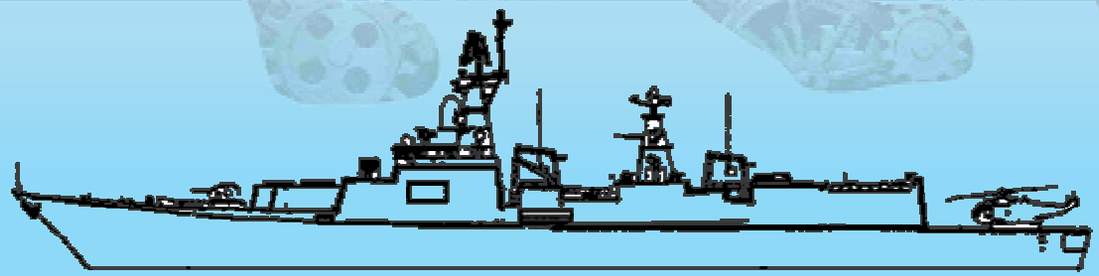
# INDIGENISATION OF NBC FILTER
# (HVAC System)

NBC Filters form an important part of Air Filtration Unit of HVAC System. NBC Filter removes the Nuclear, Biological & Chemical agents from the air and supplies clean air to CITADEL Zones. Till date this item has been imported as part of HVAC System from M/s Axima, France. MDL has now successfully indigenised this item through M/s Nikitish Enterprises, Shivane, Pune with assistance from M/s DRDE, Gwalior.



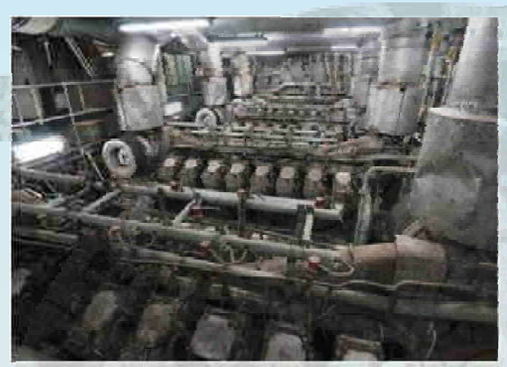


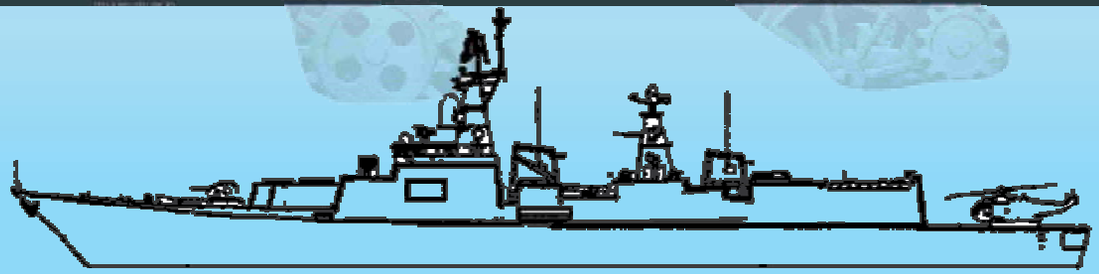
| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Filter/Type | HEPA/Activated Carbon |
| 2. | Maximum Air Flow capacity | 300 Cu M/Hr |
| 3. | Conforming Specifications | NATO STANAG 4447 |
| 4. | Construction/Flow | Cylindrical / Axial Flow |
| 5. | Air Pressure Drop | 550 Pascals |
| 6. | Total Qty/Ship | 80 Nos. |

# INDIGENISATION OF HIGH TEMPERATURE EXHAUST GASKETS

The High Temperature Exhaust Gaskets is a critical item, used in diesel exhaust system onboard ships and submarines. Till date this item has been imported from foreign supplies resulting in high cost and long lead time in procurement. The challenges involved in indigenising this High Temperature Exhaust gasket lay in developing a material for the gasket that withstands not only pressure of 150 Bars but also temperature in excess of 700 Degrees. Also the foreign firms making this item had patented its design.MDL has now successfully indigenised this item through M/s PILOT Gasket Engineers., Mumbai.

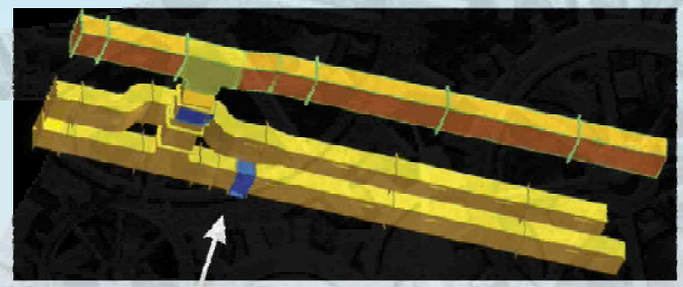



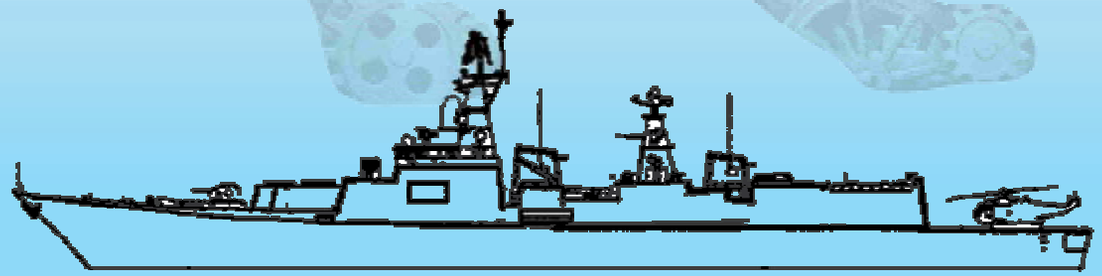
| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Material | Monel 400 & Mica |
| 2. | Thickness | Monel - 2 mm<br>Mica - 0.5 mm |
| 3. | Diameter | Inner - 171 mm<br>Outer - 222mm |
| 4. | Temperature | 750 °C |



# INDIGENISATION OF FIRE DAMPER (HVAC SYSTEM)

The Fire Damper is a critical item of HVAC System, used for preventing travel and spread of fire through the air ducts in to the compartments / areas in case of fire. These are installed in air ducts at its entry to critical compartments/areas. The damper blades regulates or shuts off the flow of air as soon as the air temperature reaches a threshold value. Till date this item has been imported from M/s Axima, France as part of HVAC system. MDL has now successfully indigenised this item through M/s SAF Refrigeration Engineering, Mumbai

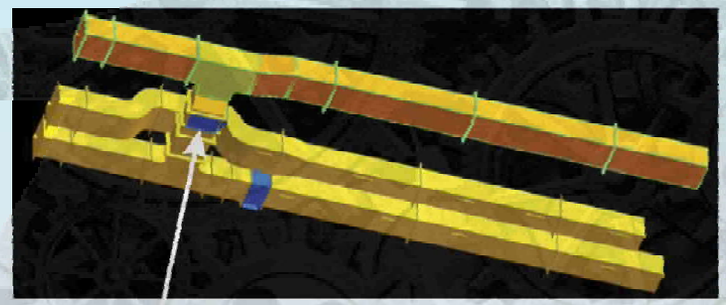


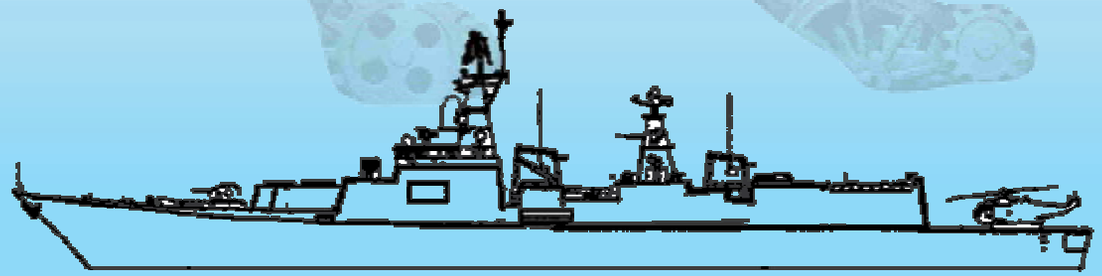


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Size/Air Flow | 600x400x300 mm/8300 M3/hr.<br>500x350x400 mm/6000 M3/hr.<br>400x300x350 mm/4200 M3/hr.<br>350x250x350 mm/3050 M3/hr.<br>300x200x250 mm/2100 M3/hr. |
| 2. | Material | M.S. IS:2062 Galvanised. |
| 3. | Thickness | Damper Body – 3 mm<br>Damper Flange – 3mm<br>Damper Blade – 1.5 mm |
| 4. | Actuator for motorised operation of damper | 24 VDC |

# INDIGENISATION OF CONTROL DAMPER (HVAC SYSTEM)

The Control Damper is a critical item of HVAC System, used for stopping/controlling the degree of air flow into the compartments / areas through the air ducts. The damper blades regulate or shuts off the flow of air as per the control signals received from the HVAC system. Till date this item has been imported from M/s Axima, France as part of HVAC system. MDL has now successfully indigenised this item through M/s SAF Refrigeration Engineering, Mumbai

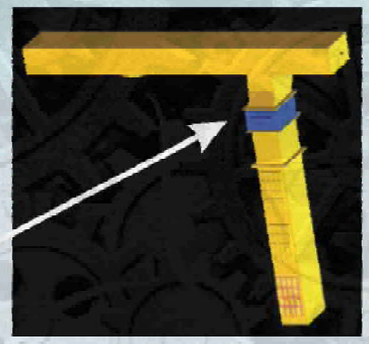


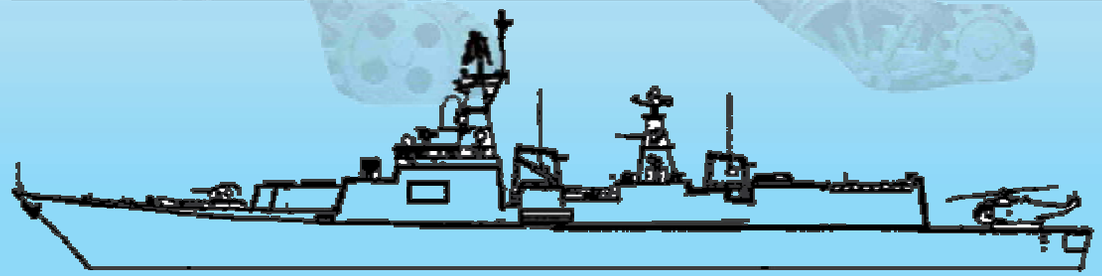


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Size/Air Flow | 600x400x450 mm/8600 M3/hr.<br>500x350x400 mm/6300 M3/hr.<br>400x300x350 mm/4300 M3/hr.<br>350x250x300mm/3150 M3/hr.<br>300x200x250 mm/2150 M3/hr. |
| 2. | Material | M.S. IS:2062 Galvanised. |
| 3. | Thickness | Damper Body – 3 mm<br>Damper Flange – 2mm<br>Damper Blade – 2 mm |
| 4. | Actuator for motorised operation of damper | 24 VDC |

# INDIGENISATION OF SMOKE DAMPER (HVAC SYSTEM)

The Smoke Damper is a critical item of HVAC System, used for preventing travel and spread of smoke into the compartments/areas through the air ducts in case of fire. These are installed in air ducts at its entry to critical compartments/areas. The damper blades regulate or shuts off the flow of air as soon as the smoke is detected by the smoke detectors. Till date this item has been imported from M/s Axima, France as part of HVAC system. MDL has now successfully indigenised this item through M/s SAF Refrigeration Engineering, Mumbai.

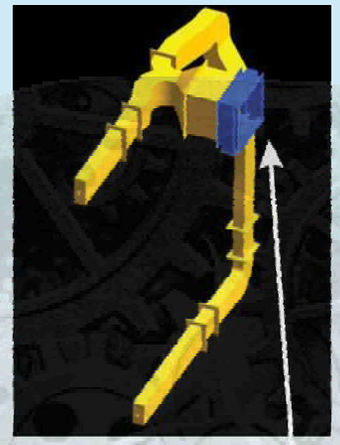




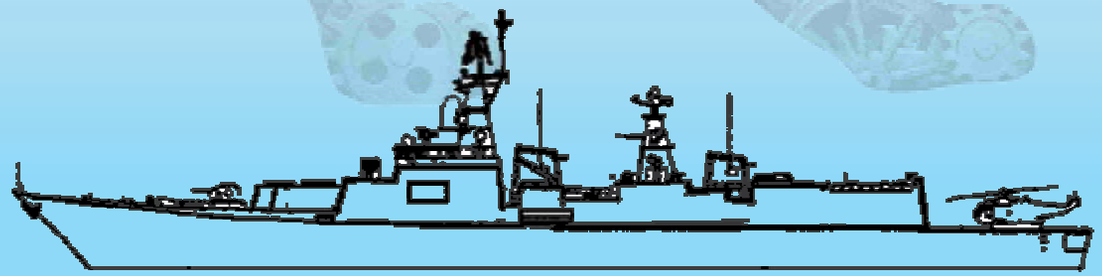
| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Size/Air Flow | 600x400x450 mm/9300 M3/hr.<br>500x350x400 mm/6800 M3/hr.<br>400x300x350 mm/4600 M3/hr.<br>350x300x350 mm/4100 M3/hr.<br>300x200x250 mm/2300 M3/hr. |
| 2. | Material | M.S. IS:2062 Galvanised. |
| 3. | Thickness | Damper Body – 2 mm<br>Damper Flange – 3mm<br>Damper Blade – 2 mm |
| 4. | Actuator for motorised operation of damper | 24 VDC |

# INDIGENISATION OF FLAME PROOF GAUZE (HVAC SYSTEM)

The Flame Proof Gauze is a critical item, used for arresting propagation of fire through the air ducts in to other compartments/areas onboard ship. Till date this item has been imported from M/s Axima, France. MDL has now successfully indigenised this item through M/s SAF Refrigeration Engineering, Mumbai.

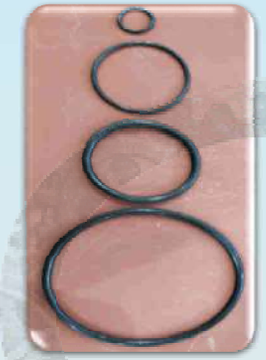


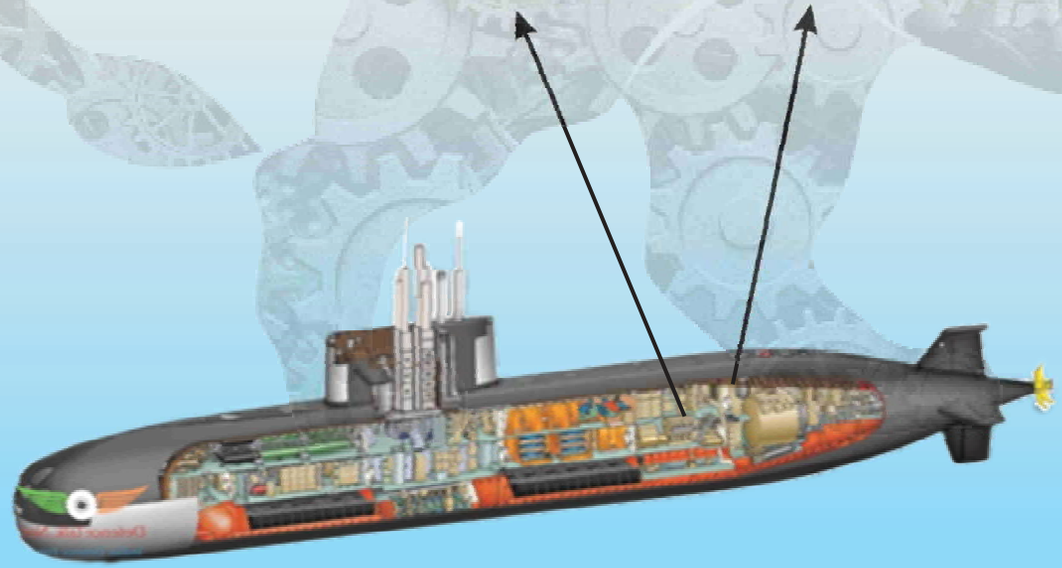
| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Size/Air Flow | 300x300mm/800 M3/hr.<br>400x400mm/1400 M3/hr.<br>500x500xmm/2200 M3/hr.<br>600x600mm/3200 M3/hr. |
| 2. | Material | Body-M.S. IS:2062 Galvanised.<br>Flame Arrestor- S.S. 304 |
| 3. | Thickness | Body – 3 mm<br>Cover– 3mm |



# INDIGENISATION OF O-RINGS
## (Scorpene Submarine)

The O-ring is a critical item, used for different sealing applications and pipe flanges in various systems on board submarine. Till date this item has been imported from M/s Naval Group, France. MDL has now successfully indigenised this item through M/s James Walker Imarco, Mumbai.

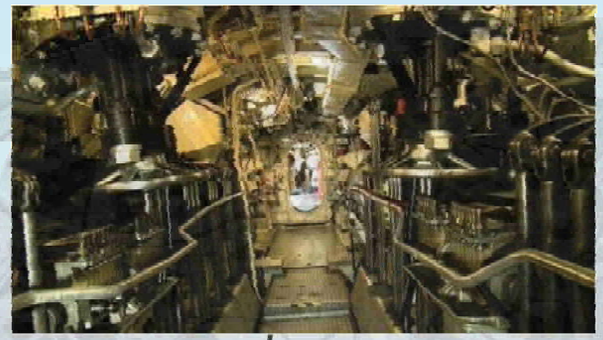


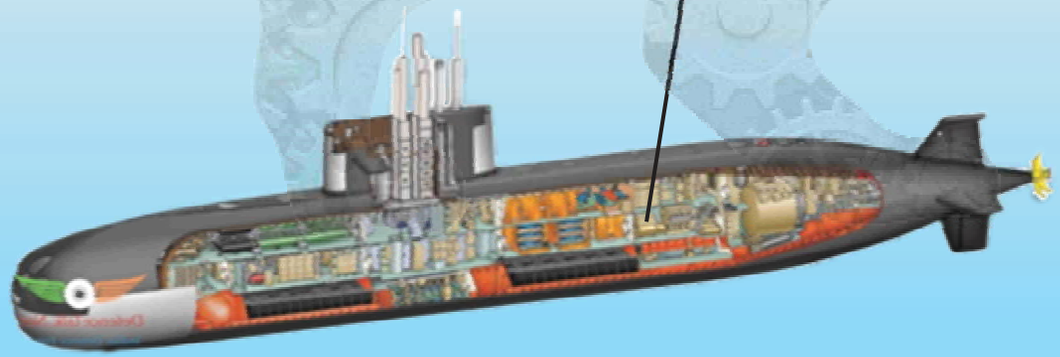


| S No | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type | Various Sizes |
| 2. | Ring Dia | Ranging from 1.8 to 7 mm |
| 3. | Material | NBR |
| 4. | Class | 20A8GN/AN as per NF-L-17-120 |
| 5. | Micro Hardness (IRHD) | 84 |
| 6. | Elongation at Break (Percentage) | 240 |
| 7. | Tensile Strength | 22.1 MPa |

# INDIGENISATION OF E- GLASS SELF ADHESIVE INSULATION TAPE
## (Scorpene Submarine)

E-Glass cloth with self ADHESIVE Insulation Tape is used onboard Submarine on insulation trunking. It provides thermal insulation and is insensitive to moisture. Till date this item has been imported from M/s Naval Group, France. MDL has now successfully indigenised this item through M/s James Walker Imarco, Mumbai.



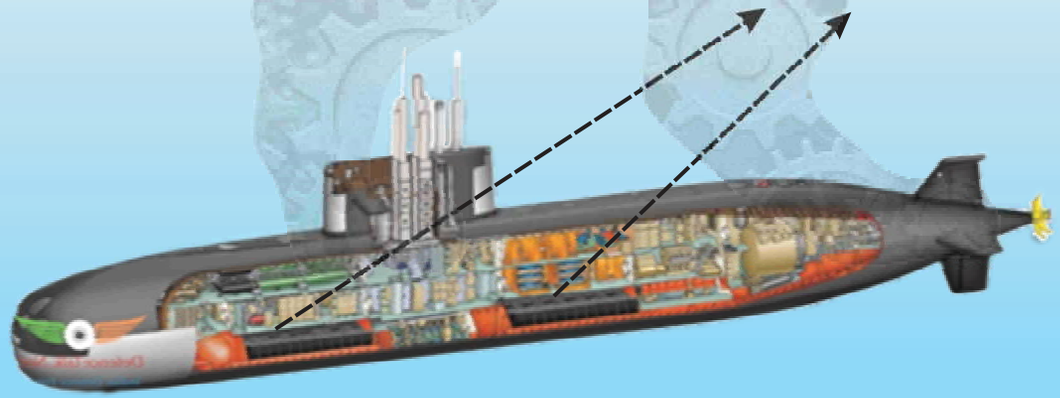


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Size (Width x Thickness) | 1000 mm x 0.32 mm thick |
| 2. | Density | 1.692 gm/cc |
| 3. | Ultimate Tensile Strength | 81.63 N/mm2 |
| 4. | Warp | 18 yarns/cm |
| 5. | Weft | 12 Coups-picks/cm |
| 6. | Nominal construction | 4H Satin Weave |
| 7. | Glass Content | 75.8 % |

# INDIGENISATION OF BATTERY LOADING TROLLEY
## (Scorpene Submarine)

Battery Loading Trolley onboard Scorpene Submarine is an important item for loading of submarine battery in the battery compartment. There are two battery compartments each containing 180 batteries. All these batteries are loaded inside the battery compartments by using this Battery Loading Trolley.

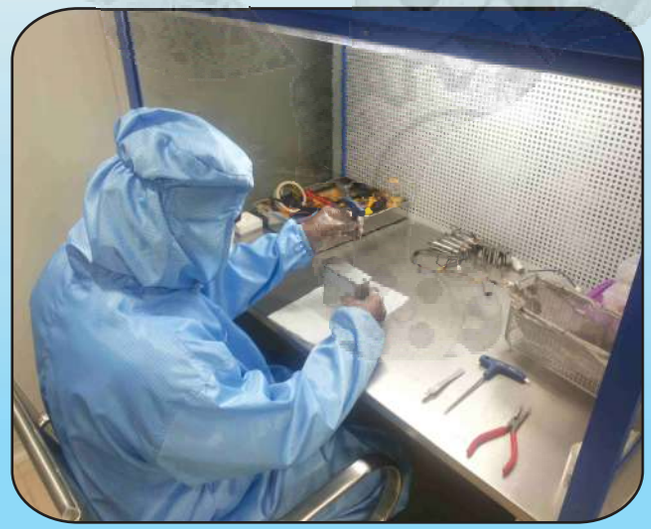
Battery Compartment



| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Dimensions | Trolley (Fwd Compt.) – 1072 X 434 mm<br>Trolley (Aft Compt.) - 1204 X 467 mm |
| 2. | Overall Weight | Trolley (Fwd Compt.) – 128 Kg<br>Trolley (Aft Compt.) - 130 Kg |
| 3. | Material | S355 |
| 4. | Max. Working Load | 700 Kg. |
| 5. | Test Load (Static) | 1050 Kg. |

# TEST & TRIALS OF EQUIPMENT / ITEMS INDIGENISED AT VENDORS PREMISES


# TEST & TRIALS OF EQUIPMENT / ITEMS INDIGENISED AT VENDORS PREMISES



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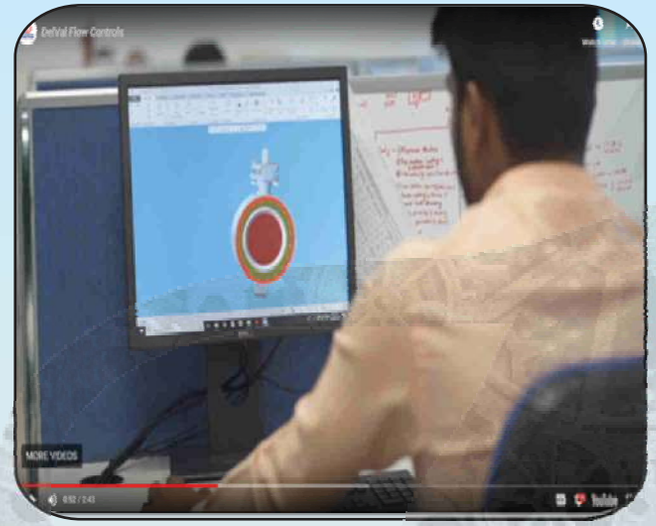




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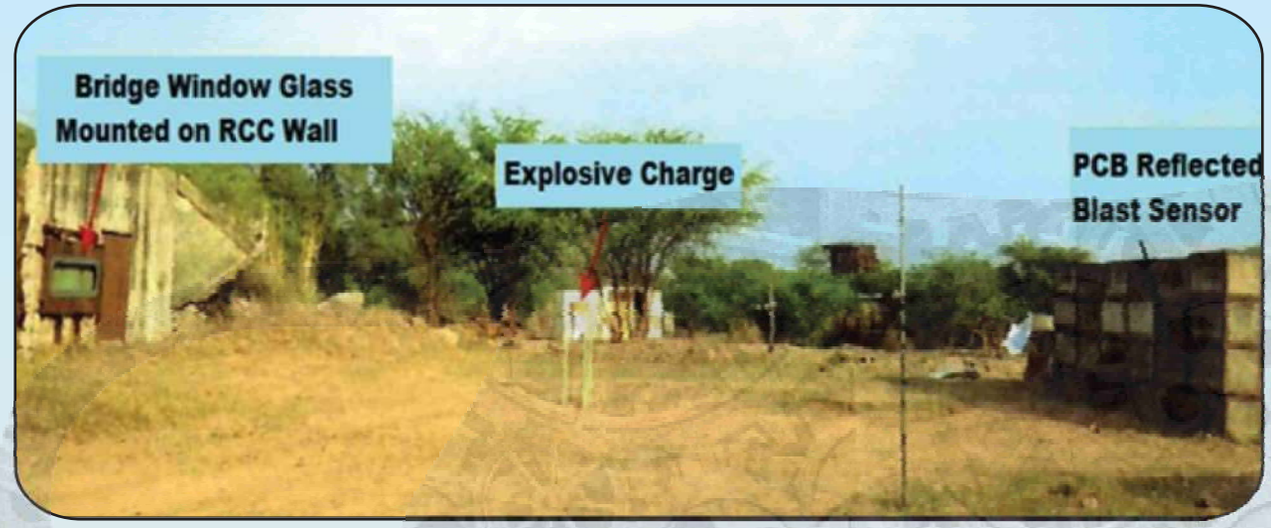


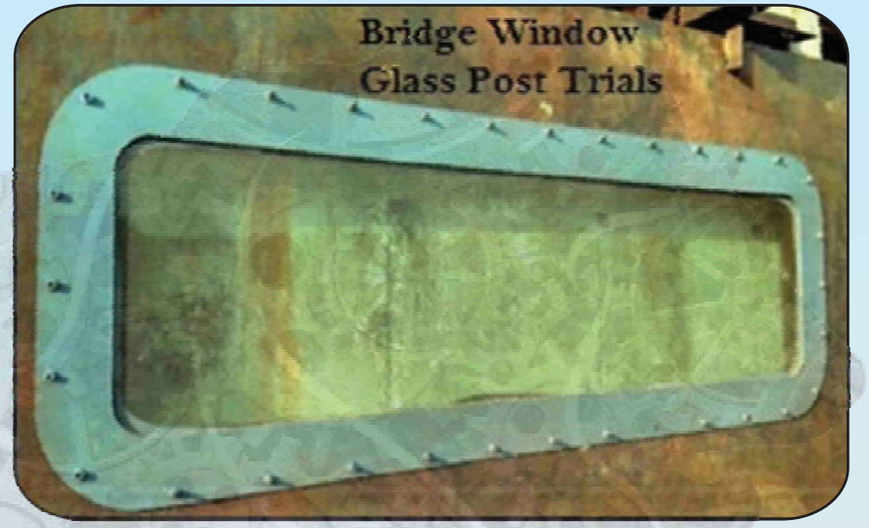


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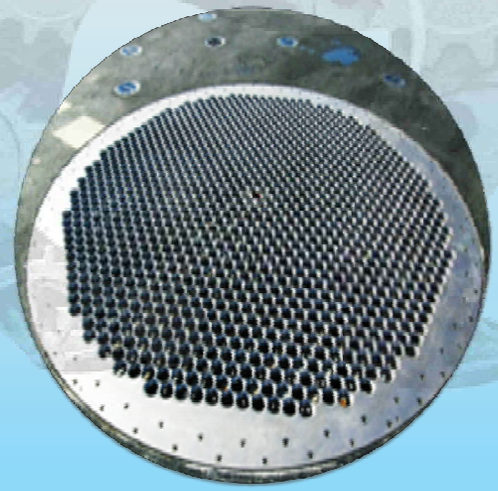

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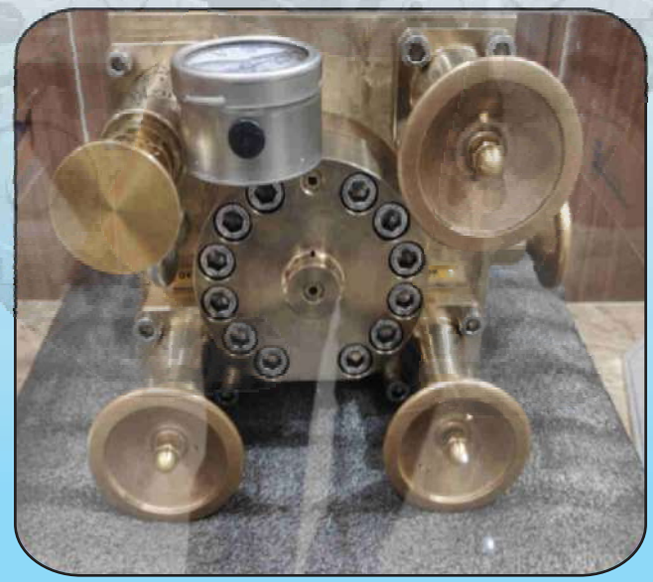
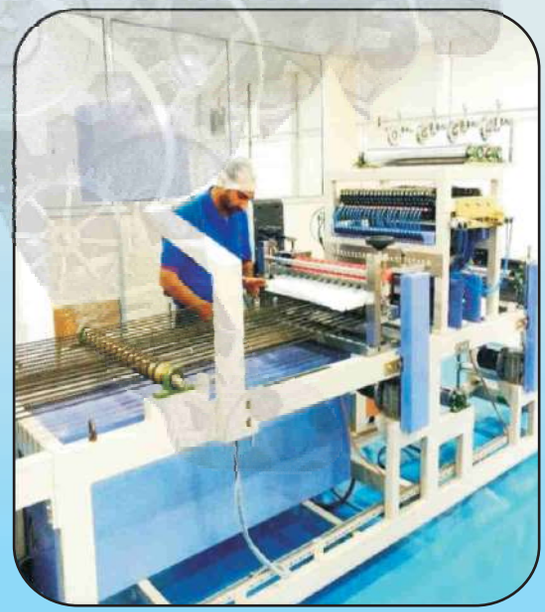


# TEST & TRIALS OF EQUIPMENT / ITEMS INDIGENISED AT VENDORS PREMISES

# TEST & TRIALS OF EQUIPMENT / ITEMS INDIGENISED AT VENDORS PREMISES

# TEST & TRIALS OF EQUIPMENT / ITEMS INDIGENISED AT VENDORS PREMISES







# TEST & TRIALS OF EQUIPMENT / ITEMS INDIGENISED AT VENDORS PREMISES






# MAJOR EQUIPMENT / ITEMS UNDER INDIGENISATION

## AC-PLANTS (SUBMARINES)

Earlier Source of Import -M/s M/s Snori, France

Being Indigenised By - M/s Shree Refrigerators, Karad

## REF-PLANTS (SUBMARINES)

Earlier Source of Import -M/s Snori, France

Being Indigenised By - M/s ACCEL, Ahmedabad

## SACRIFICIAL ZINC ANODE FLANGES (SUBMARINES)

Earlier Source of Import -M/s Metrocontrol, Spain.

Being Indigenised By - M/s Sargam Metals , Chennai.

## BATTERY MONITORING SYSTEM (SUBMARINES)

Earlier Source of Import -M/s Develec, France.

Being Indigenised By - M/s Precision Power Products, Aurangabad

## PMMA GLASS (SUBMARINES)


Earlier Source of Import -M/s DCNS, France.

Being Indigenised By - M/s Jeet & Jeet Glass, Jaipur

## MAGAZINE FIRE FIGHTING SYSTEM (SHIPS)

Earlier Source of Import -M/s Rosoboron export, Russia

Being Indigenised By - M/s CFEES, DRDO,New Delhi along with MDL, Mumbai

## VENTILATION FANS (SHIPS)

Earlier Source of Import -M/s Axima, France

Being Indigenised By - M/s SAF Referigeration, Mumbai

## SMOKE EXTRACTION FANS (SHIPS)

Earlier Source of Import -M/s Axima, France

Being Indigenised By - M/s SAF Referigeration, Mumbai

## OILY WATER SEPARATOR (SHIPS)

Earlier Source of Import -M/s Vector Marine, UK

Being Indigenised By - M/s Power Transformer & Sales, Pvt., Ltd., Coimbatore

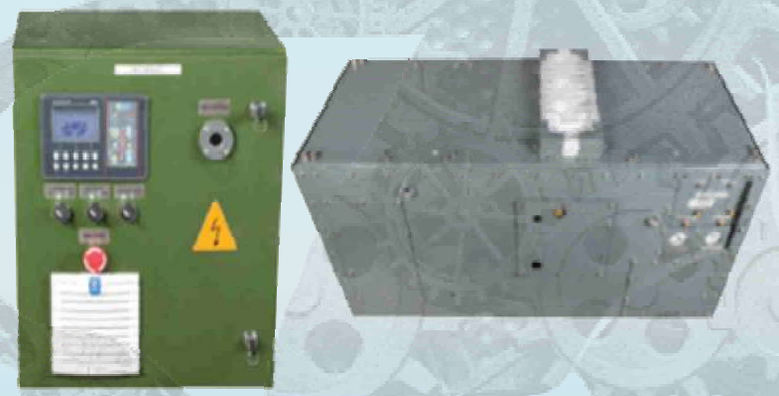
## STATIC FREQUENCY CONVERTERS (SUBMARINES)

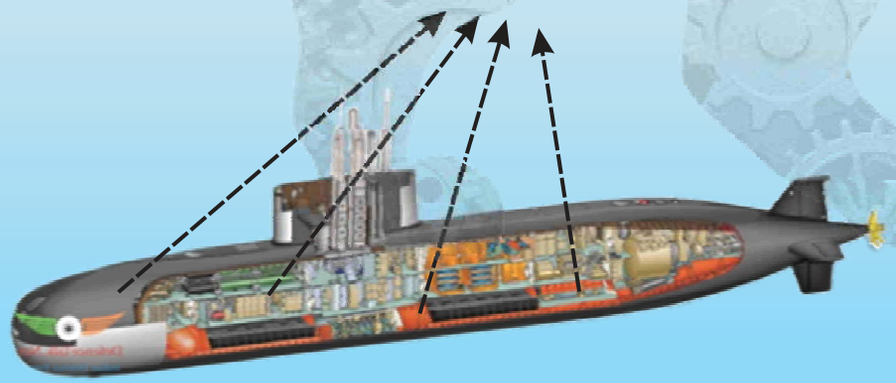
Earlier Source of Import -M/s DCNS, France

Being Indigenised By - M/s Accurate Controls, Pune

# INDIGENISATION OF AIR CONDITIONING PLANTS
## (Scorpene Submarine)

Air Conditioning Plants used on-board scorpene submarines are of decentralised type self-contained Air Conditioning units (ACUs), 11 in numbers installed in 11 different compartments to maintain appropriate air temperature and hygrometry quality conditions inside the Vessel. Till date these plants have been imported from M/s Snori, France. MDL is now indigenising these Air Conditioning Plants through M/s Shree refrigerators, Kharad.





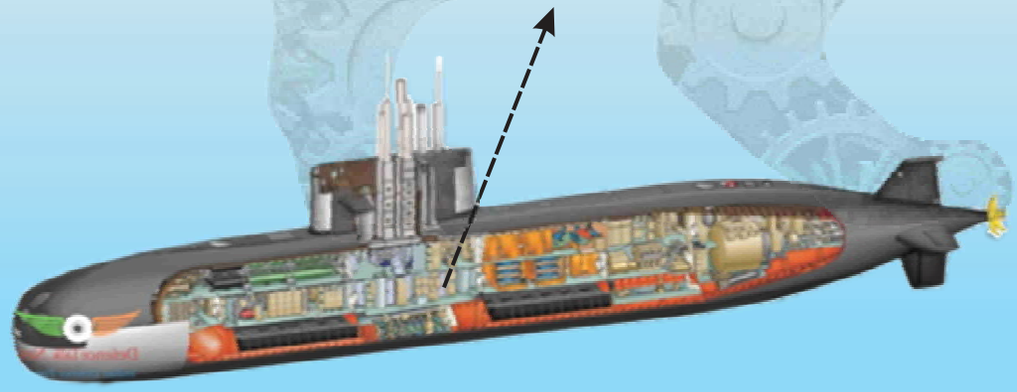
| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type / Qty | Direct Cooling Type / 11 Plants |
| 2. | Compressor Type | **Hermetically/Semi hermetically sealed** |
| 3. | Refrigerant | **R-134 a / equivalent** |
| 4. | Cooling capacity (KW) | |
| 5. | Cooling airflow rate (m3/hr) | |
| 6. | Conforming Standard | DEF STAN 08-159(PT2)/1:2001 (erstwhile NES 102:1983 Vol 2) |

| ACU 1 | ACU 2 | ACU 3 | ACU 4 | ACU 5 | ACU 6 | ACU 7 | ACU 8 | ACU 9 | ACU 10 | ACU 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| 11.6 | 20 | 5 | 5 | 5 | 5 | 16.4 | 9.6 | 19.2 | 10.5 | 14.6 |

| ACU 1 | ACU 2 | ACU 3 | ACU 4 | ACU 5 | ACU 6 | ACU 7 | ACU 8 | ACU 9 | ACU 10 | ACU 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3000 | 3000 | 1000 | 1000 | 1000 | 1000 | 2500 | 1900 | 3800 | 3000 | 2400 |

# INDIGENISATION OF REFRIGERATION PLANTS
## (Scorpene Submarine)

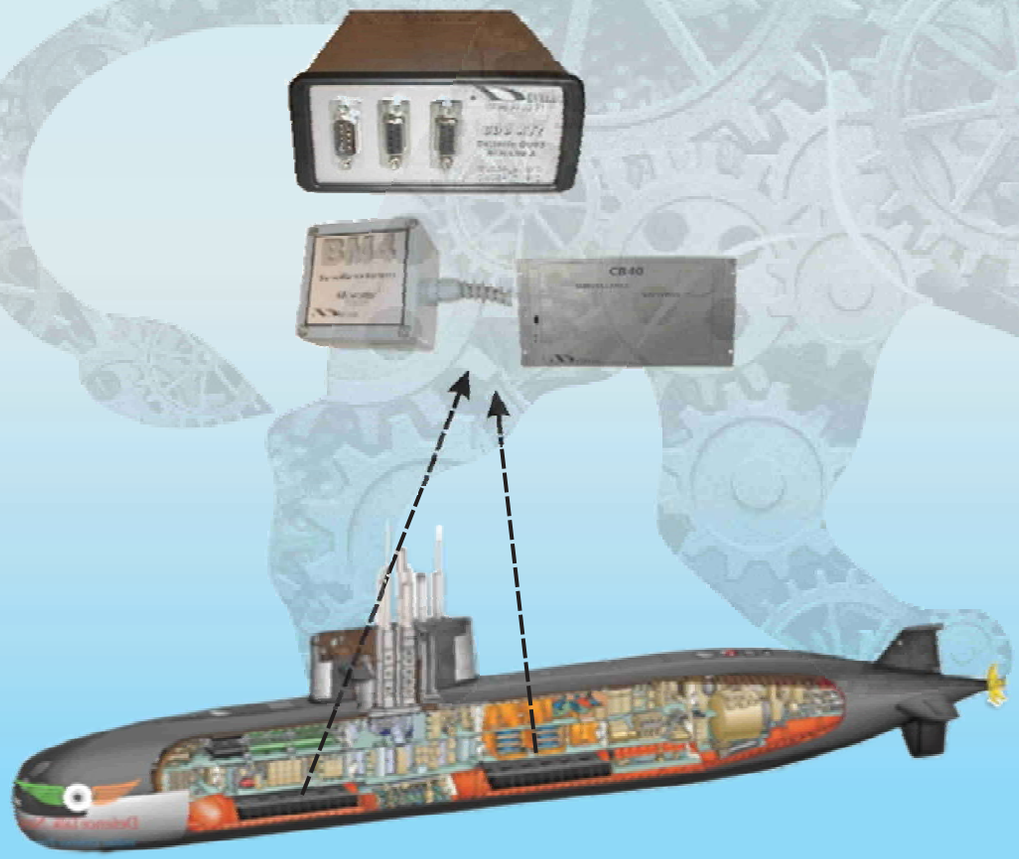
Refrigeration Plants used on-board scorpene submarines are used to maintain appropriate air temperature & Moisture inside Cold & Cool Rooms for storage of fresh and dry rations. There are two Refrigeration Plants which initially start together and then work in tandem to cater for the total load of cool & cold rooms & maintain the requisite temperatures. Till date these plants have been imported from M/s Snori, France. MDL is now indigenising these Refrigeration Plants through M/s ACCEL, Ahmedabad.



| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type | Direct Air Cooling Condenser Unit |
| 2. | Qty | 2 Plants |
| 3. | Compressor Type | **Hermetically/Semi hermetically sealed** |
| 4. | Refrigerant | Freon R 404A |
| 5. | Conforming Standard | Def Stan 158 |
| 6. | Refrigerating Capacity per unit | 1.1 kW |
| 7. | Cool Room Temp | +3 °C |
| 8. | Cold Room Temp | –20 °C |

# INDIGENISATION OF BATTERY MOINITORING SYSTEM
## (Scorpene Submarine)

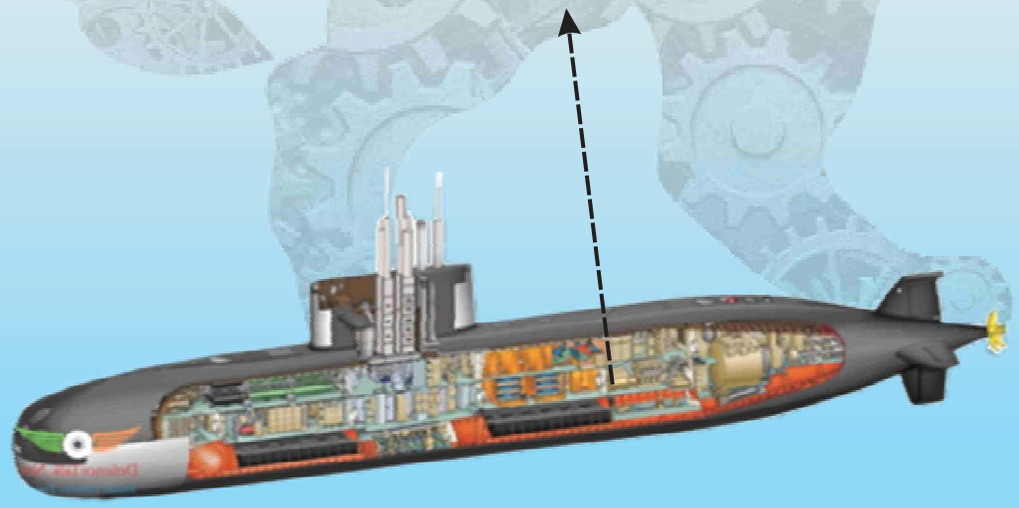
The Battery Monitoring System (BMS) is used onboard Scorpene Submarines for continuous measurement and logging of Cell parameters viz. Cell Voltage, Electrolyte Temperature, Electrolyte Level & Charge/ Discharge current measurements. In Scorpene Submarine there are total of 360 Cells. These Cells are grouped in two compartments containing 180 Cells each. In addition, the BMS also performs computation of average voltage, group voltage, average temperature, residual capacity, battery endurance and provides warnings whenever Cell Voltage, Electrolyte Temperature and Electrolyte Level are not within predefined values. Till date this system has been imported from M/s Develec, France. MDL is now indigenising this system through M/s Precision Power Product, Aurangabad.



| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Configuration | Main control unit (MCU)<br>Peripheral Devices (PDs)<br>Laptop PC |
| 2. | Main Control Unit (MCU) | Single Board Computer (SBC) |
| 3. | Peripheral Devices (PDs) | Suitable for measuring cell parameters viz. terminal voltage, electrolyte temperature and electrolyte level of each cell |
| 4. | Laptop PC | Suitable for trouble shooting, reloading the system software as well as acts as repository for storing data of BMS |
| 5. | Operating System | LINUX operating System (latest version) with QT (latest version) as the front end |
| | Cell Voltage | Range: 1.5 to 3 V; Accuracy: ±0.002V; Resolution: 0.001V |
| | Electrolyte Temperature | Range: 0 to 65°C; Accuracy: ±1°C; Resolution: 0.1°C |
| | Governing Specifications | IS/IEC 600079-0:2007 and IS/IEC 60079-18:2009 Ex mb IIC T4 Gb(0°C <= Ta <=60°C) for explosive atmosphere inside the battery pit environment. |

# INDIGENISATION OF SACRIFICIAL ZINC ANODE FLANGES
## (Scorpene Submarine)

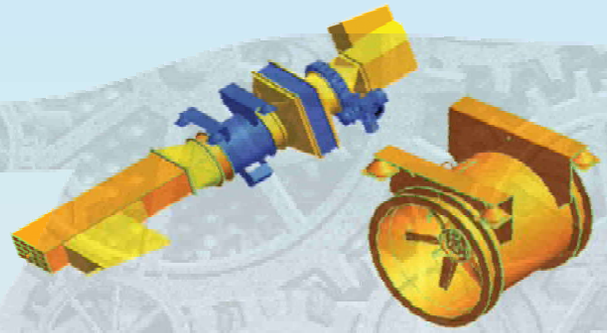
Sacrificial Zinc Anode Flanges are used onboard to control corrosion of pipes, valves, pumps etc which are in contact with seawater, by Galvanic Cathodic Protection process. There are two types of Sacrificial Zinc Anode Flanges (a) Operating Pressure 35 Bars (b) Operating Pressure 13 Bars. There are about 100 Sacrificial Zinc Anode Flanges required per boat. Till date this item has been imported from M/s Mechanizados, Spain. MDL is now indigenising these items through M/s Sargam Metals, Chennai.

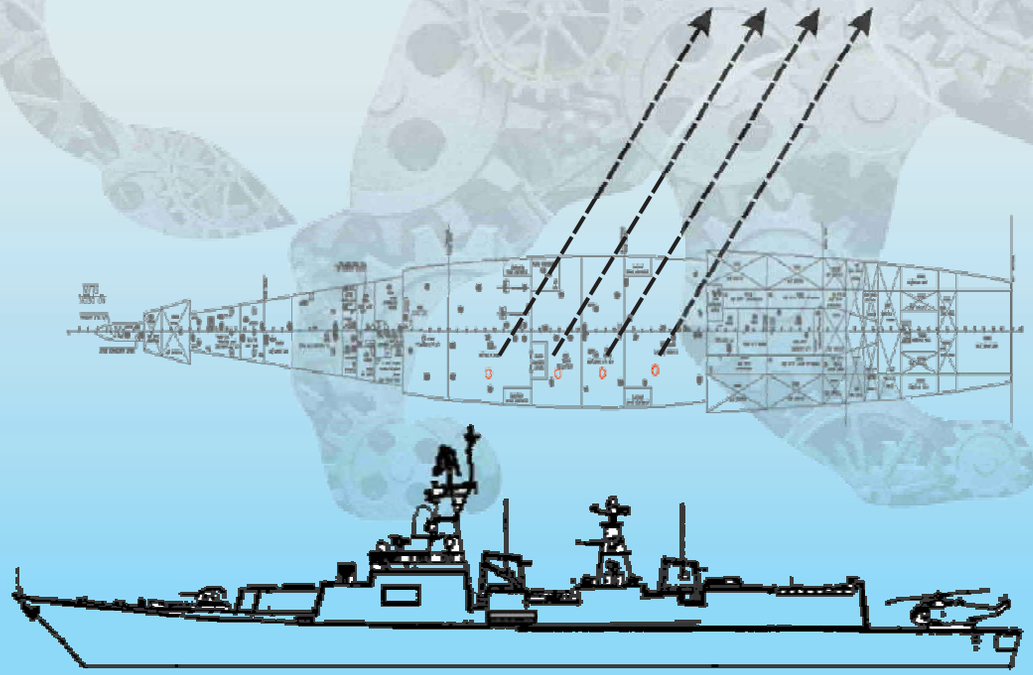


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Types of Flanges | Operating Pressure 13 Bars<br>Operating Pressure 35 Bars |
| 2. | Material | Non alloy steel S355 K2G3<br>Non alloy steelS355 K2+N |
| 3. | Nominal Dia (mm) | 20, 32, 40, 50, 65, 80, 100 & 125 |
| 4. | Governing Standards | NF EN 10204, 01/2005 |

# INDIGENISATION OF VENTILATION FANS
# (HVAC System)

Ventilation Fans form a critical part of HVAC System and are used for supply of fresh air, removal of exhaust & recirculation of air onboard ships. Till date, this item has been imported as part of HVAC System from M/s Axima, France, M/s Johnson Controls, UK, and M/s IMTECH, Germany. MDL is now indigenising these Fans through M/s SAF Refrigeration, Mumbai

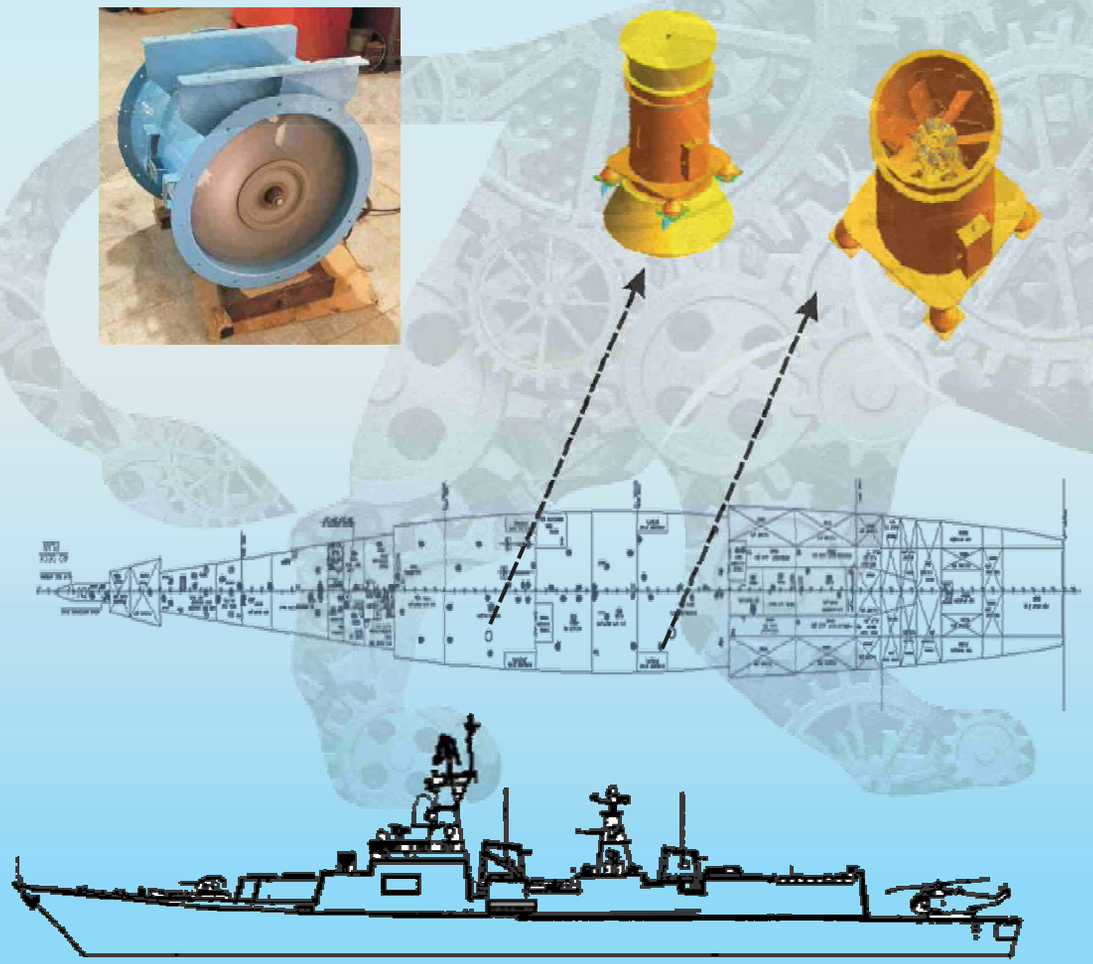




| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type/Construction | Centrifugal / Axial |
| 2. | Capacity / Air Flow Quantity | 2000 -12000 Cu.M /Hr |
| 3. | Noise & Vibration | Sound Level < 70 dB @ 1 Meter Distance |
| 4. | Motor | Conforming to EED-Q-071 Rev4 (IS325) |
| 5. | Motor Operating Voltage | 380V/415V, 3PH, 3 Wire, 50Hz |
| 6. | Shock Standard | Fan & Motor Assembly Conforming to NSS-II |

# INDIGENISATION OF SMOKE EXTRACTION FANS
## (HVAC System)

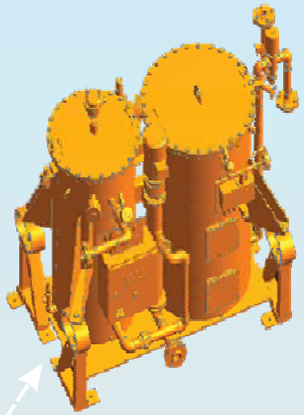
Smoke Extraction Fans form a critical part of HVAC System and are used for removal of exhaust & high temperature smoke arising in case of any fire in the ship compartments. Till date, this item has been imported as part of HVAC System from M/s Axima, France, M/s Johnson Controls, UK, and M/s IMTECH, Germany. MDL is now indigenising these Fans through M/s SAF Refrigeration, Mumbai.

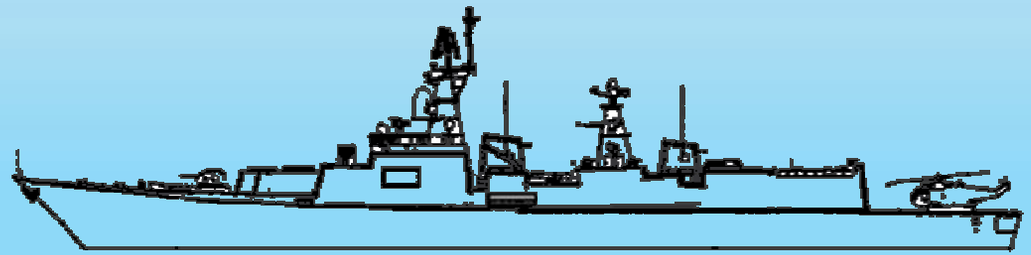


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Type | Axial |
| 2. | Capacity / Air Flow Quantity | 4000-6000 Cu.M / Hr |
| 3. | Noise & Vibration | Sound Level < 70 dB @ 1 Meter Distance |
| 4. | Motor | Conforming to EED-Q-071 Rev4 (IS325) |
| 5. | Motor Operating Voltage | 380V/415V, 3PH, 3 Wire, 50Hz |
| 6. | Motor Operating Parameters | Motor shall operate at 400 $^{0}$C for 2 Hrs |
| 7. | Shock Standard | Fan & Motor Assembly Conforming to NSS-II |

# INDIGENISATION OF OILY WATER SEPARATOR

Oily Water Separators on board warships are used for separating oil from bilge water. Oily Water Separator is of plate or coalesce type. It has oil content meter and alarms for continuous monitoring of oil in dirty water. The functions of Oily Water Separator are as per IMO: MARPOL 73/78, Annex-1, Regulation 16. Till now this item has been imported from M/s Victor Marine, UK. MDL is now indigenising this item through M/s Power Transforms Sales Pvt Ltd, Coimbatore.

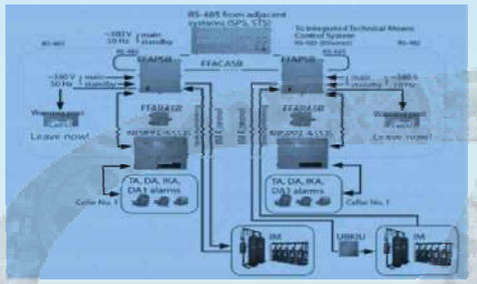


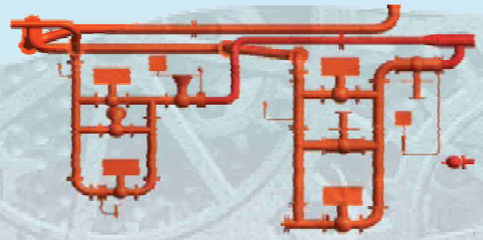


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Function | Separation of Oil from Water |
| 2. | Capacity | 5 TPH |
| 3. | Components | 15 ppm Bilge Separator,<br>15ppm Bilge<br>Alarm, Bilge Pump and Control &<br>Monitoring Instruments |

# INDIGENISATION OF MAGAZINE FIRE FIGHTING SYSTEM (MFFS)

Magazine Fire Fighting System (MFFS) installed on board warships is a very critical system for prevention of fire in Magazine compartments and Hanger. MFFS consists of Sprinkling and Inhibitor Systems, which get activated as soon as threshold levels for on set of fire is sensed by a set of temperature, pressure and infrared sensors installed in these compartments. MDL is now indigenisingf this system jointly with M/s CFEES, DRDO, New Delhi.





MFFS Installation in one of the Lobby outside the Magazine compartment

| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Temp Sensor | Bimetallic type with response time < 0.8 Sec<br>Alarm threshold =50 °C<br>System Activation Threshold=70 °C |
| 2. | Pressure Sensor | Diaphragm type<br>Range = 0.07-0.1 Kg/cm2 above atmospheric pressure<br>Response time = 0.2 Sec. |
| 3. | Infrared Sensor | Response time - 15ms with optical field view of 50° |
| 4. | Operating temp/RH | All sensors are required to withstand 200 °C<br>Operating Range -10 °C to +90 °C<br>RH 95% |
| 5. | Sprinkler Operating Time | Wet Type 12 Sec<br>Dry Type 05 Sec. |
| 6. | Type Testing | As per JSS 55555 |
| 7. | Material | Piping - Cu-Ni 90/10<br>Sprinkler - Bronze/Gun Metal<br>Flanges - Gun Metal<br>Fasteners - Al Bronze |

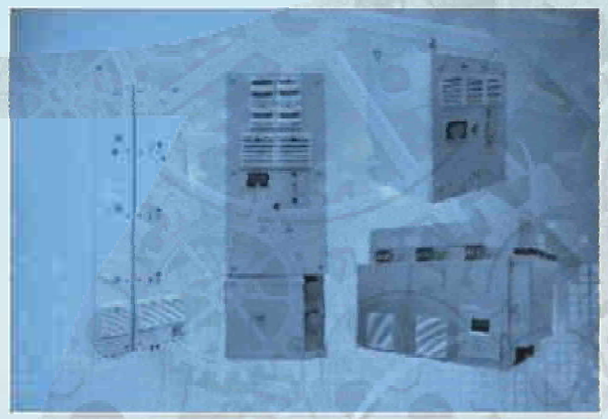
# INDIGENISATION OF PMMA GLASS
## (Scorpene Submarine)

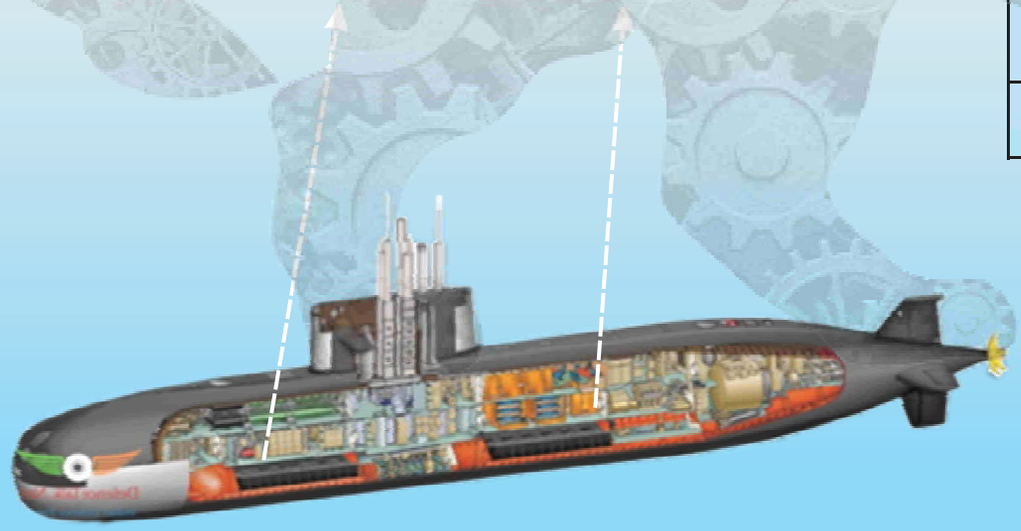
Poly Methyl Methacrylate (**PMMA**) is a transparent thermoplastic, lightweight, shatter-resistant alternative to glass used on board Scorpene Submarines as a window for navigation lights. MDL is now indigenising this item through M/s. Jeet & Jeet, Jaipur.

| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | Density | 1.18 g/cm³ |
| 2. | Melting Temp. | 160 °C |

# INDIGENISATION OF STATIC FREQUENCY CONVERTERS
## (Scorpene Submarine)

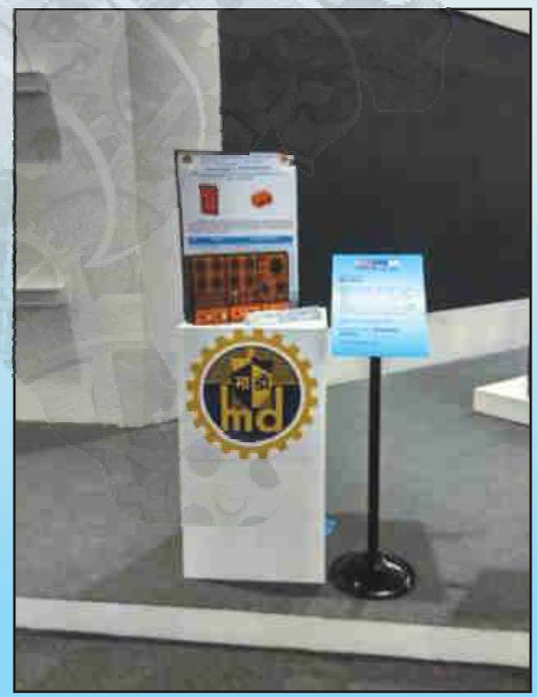
Static Frequency Converters used onboard Submarine (60 KVA & 5 KVA) are required for sophisticated electronics such as radars, gyros and weapons systems. Till date these SFCs have been imported from DCNS, France. MDL is now indigenising these SFCs through M/s. M/s Accurate Controls, Pune.



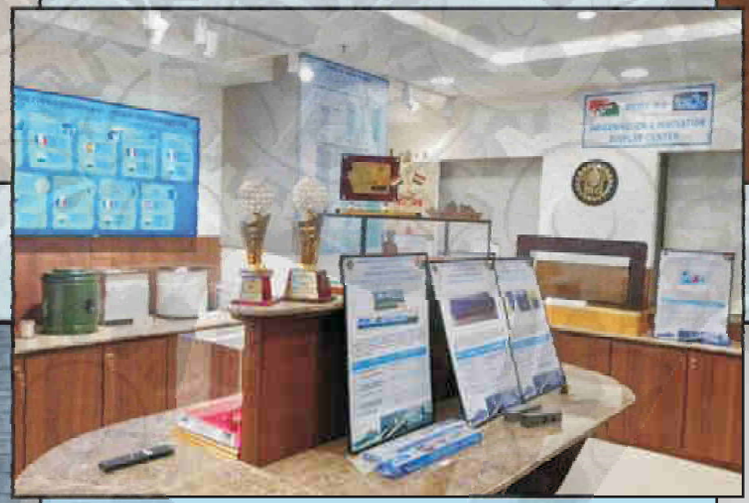


| SNo | Parameter | Specifications / Standards |
|---|---|---|
| 1. | SFC 5KVA | I/P= 270 to 504 Volts DC<br>O/P=115 V, 400Hz, 3 PH |
| 2. | SFC 60KVA | I/P= 270 to 504 Volts DC<br>O/P=115 V, 60Hz, 3 PH |
| 3. | Conforming Standards | Shock – IEC 60068-2-27, 15g/11 ms<br>EMI/EMC – MIL STD461F |
| 4. | Type Tests | JS55555 |

# DISPLAY OF INDIGENISED ITEMS AT EXHIBITIONS

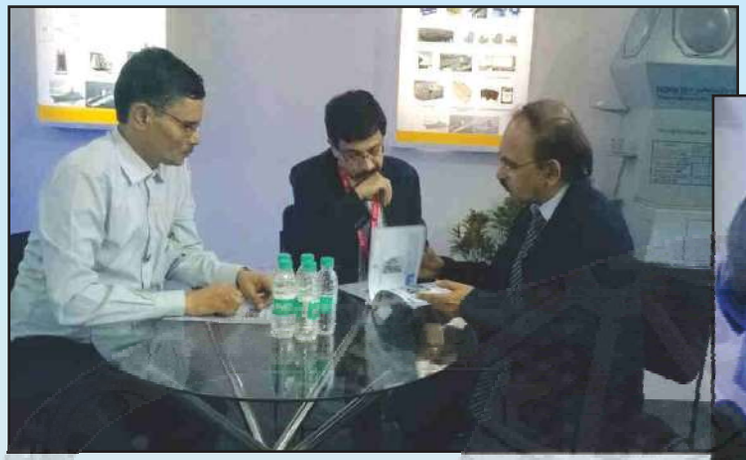



# DISPLAY OF INDIGENISED ITEMS AT IN-HOUSE DISPLAY CENTER

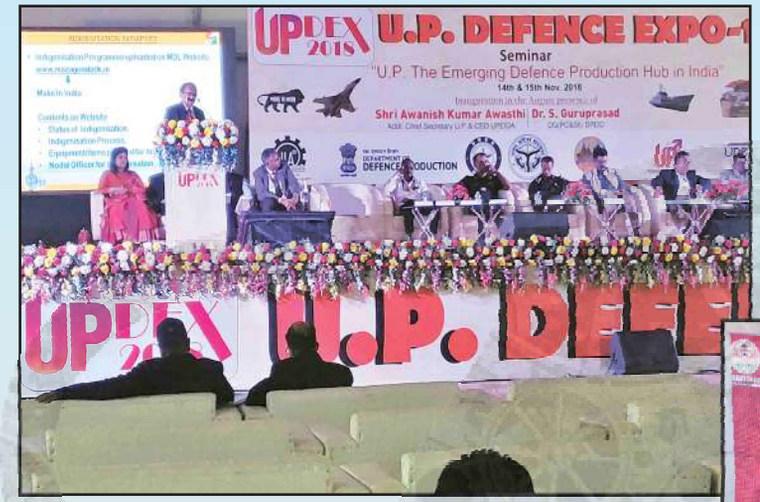


# ITEMS INDIGENISED BEING SHOWCASED TO DIGNITARIES

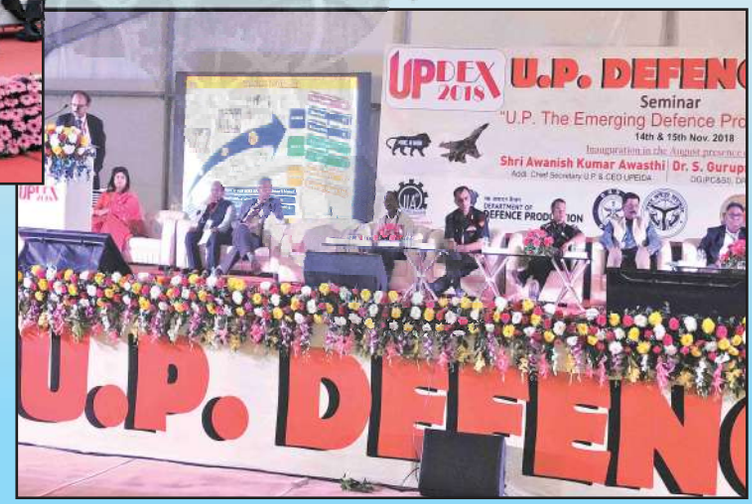

# INTERACTIONS WITH VENDORS/STAKEHOLDERS AT EXHIBITIONS & SEMINARS



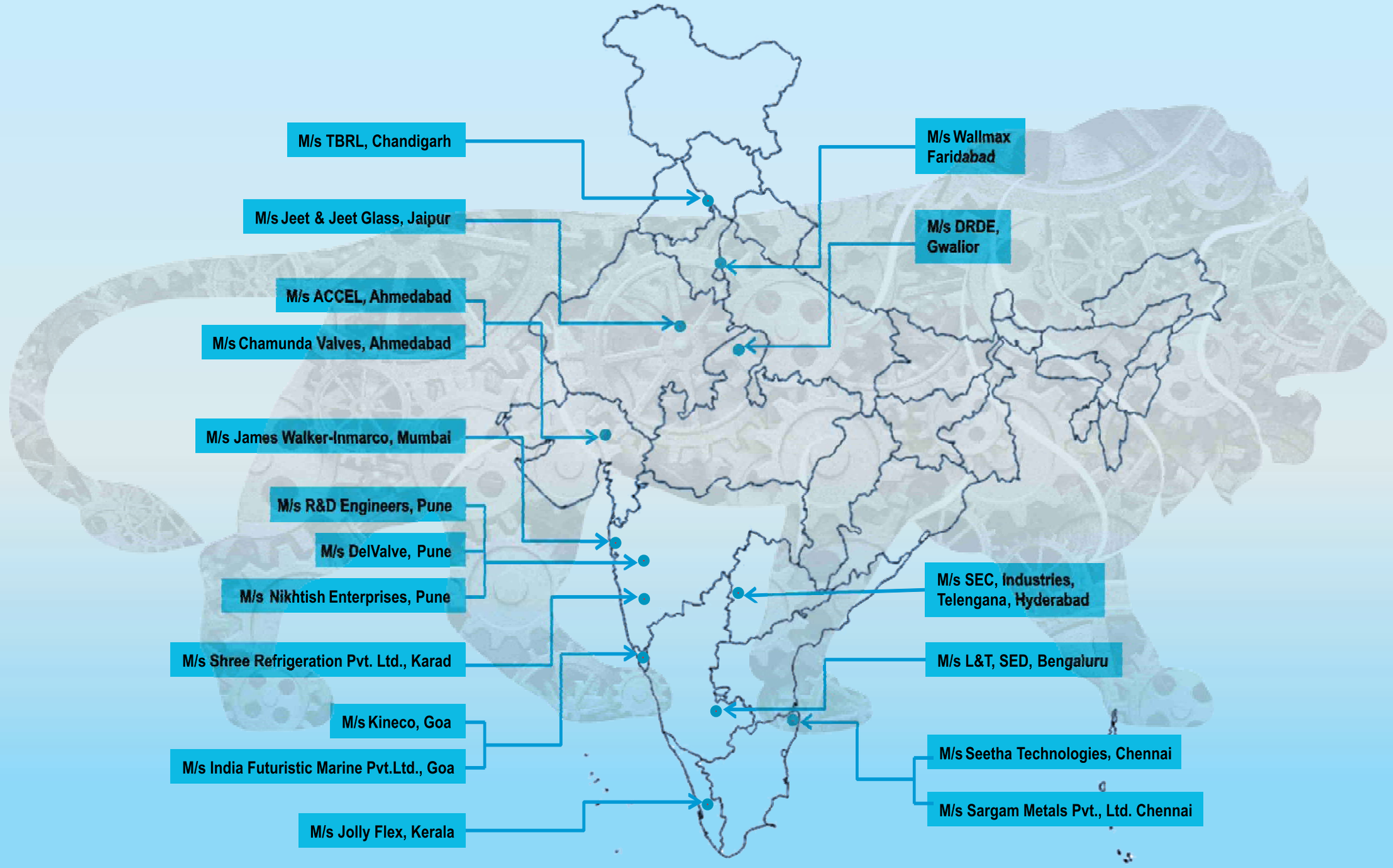
# PRESENTATIONS AT EXHIBITIONS & SEMINARS



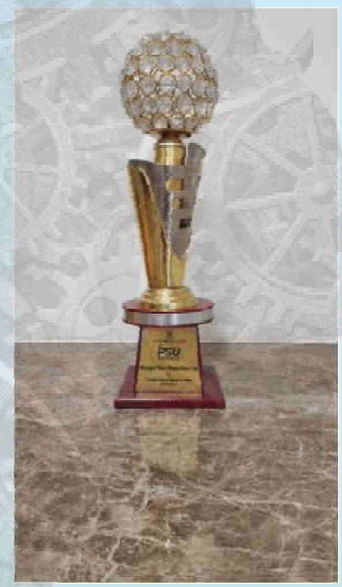


# INDIAN INDUSTRIES & ACADEMIA INVOLVED IN INDIGENISATION



# AWARD FOR PLAYING PIVOTAL ROLE IN “MAKE-IN-INDIA”

Governance Now 5th PSU Award 2018 for playing Pivotal Role in “Make-In-India” being received by Cmde (Dr.) Jawahar M Jangir, General Manager (indigenisation) from Smt Krishna Raj, Union Minister for State for Agriculture & Farmer Welfare, at Function held at a Imperial Hotel, New Delhi on 27 Feb 2018

# CONTACT DETAILS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Designed & Conceptualised
By
Indigenisation Department
Mazagon Dock Shipbuilders Limited